RAILROAD GAZETTE

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Contributions

Baggage Racks in Passenger Coaches.

TO THE EDITOR OF THE RAILROAD GAZETTE:

Perhaps there is more than one railroad in the United States which has in its coaches, baggage racks of a pattern that will hold modern baggage, such as a dress suit case. I say perhaps there is more than one, for I know of only one, and that is the much abused New York, New Haven & Hartford. Its racks hold a suit case safely. Indeed, they carry a baby safely, for I actually saw a mother try it with her infant, and the infant was safe as long as it was left there, which was not very long. It seems to me that these racks on most roads are not quite archaic but are of a pattern suited to the age of the flexible carpet bag or that article of woman's headgear which is rightly named a "fascinator." The commonest article of hand-baggage now seen on railroad trains is the suit case, and, yet, if you put one in the basket rack the brakeman promptly removes it in the pursuance of his duty to promote the safety of passengers. A short time ago I addressed a letter on this subject to Mr. George H. Daniels, "America's greatest" passenger agent, and he replied as follows:

"The matter was taken up with our mechanical and rolling stock department, and I am informed by them that all of our new equipment is supplied with long hat racks which hold three dress suit cases, the short racks holding but one. We are also arranging to equip all of our first class passenger equipment, which runs on through trains, with the long style hat racks. Most of our coaches have seats in them that are arranged so an ordinary grip will slip under the seat, thus giving plenty of room between the seats. This matter has not been lost sight of by our officials, and in any equipment provided hereafter, ample storage room will be provided by the racks."

I am neither a promoter nor a reformer. I am only writing to you for information. Do any other railroads properly care for their passengers in this minor matter?

COMMERCIAL TRAVELER.

Train Speeds on German Railroads.

Early in 1902, the German Federal Council modified the regulations for the working of railroads by increasing the maximum permissible speed of passenger trains from 56 miles to 62 miles per hour "so that delays might be made up by faster running over sections of easy gradient and the keeping of schedule time assured." Dr. Albert Kuntzemuller recently made an investigation of the running times on the ten railroad lines in Germany, the results of which were published in *Zeitung des Vereins*. These are: The Prussian State Railways operating 19,325 miles; Bavarian, 3,505 miles; Saxony, 1,900 miles; Wurtemberg, 1,150 miles; Alsace-Lorraine, 1,067 miles; Baden, 1,015 miles; Mecklenburg, 681 miles; Palatine Railways, 445 miles; Oldenburg, 319 miles; Mein-Neckar, 74 miles. The running times were taken from the summer schedule for 1902, the object of the investigation being to determine how nearly and how often train speeds approached the maximum limit under the most favorable running conditions. The regulations limit the speed of trains without continuous brakes to 37.3 miles an hour and trains with continuous brakes, in general, to 49.7 miles an hour, and under special conditions to 55.9 miles, or under the new ruling to 62.1 miles an hour. On most of the lines, with the exception of the Prussian State, there are heavy grades and sharp curves which prevent fast schedules, so that under the circumstances of limited maximum speed on down grades and the impossibility of making high speeds on the ascending grades, the schedules are exceptionally fast. There are, of course, no long distance fast runs such as are scheduled in the United States, and in most cases the distances between stops is comparatively short.

The following tables give a few of the fastest scheduled runs on each of the ten roads.

Prussian State Railways.

Average speed, m.p.h.	Run.	Distance and time. No. of trains.	Miles.	Min-utes.
53	Wittenberge-Hamburg	1	98.9 in	112
51.95	Berlin-Wittenberge	4	78.8 in	91
51.72	Wittenberge-Hagen	1	40.5 in	47
51.54	Hamburg-Hagen	2	58.4 in	68
50.21	Berlin-Halle	2	100.4 in	120

The authorized maximum speed is 55.9 m.p.h., the greatest average speed is 53. m.p.h. (Wittenberge-Hamburg), and the longest run without a stop is 107.5 miles from Berlin to Leipzig.

Bavarian State Railways.

Average speed, m.p.h.	Run.	Distance and time. No. of trains.	Miles.	Min-utes.
47.52	Munich-Gunzenhausen	1	99.8 in	126
46.39	Munich-Ratisbon	2	85.8 in	111
46.35	Furth-Bamberg	1	34.0 in	44
45.25	Munich-Augsburg	1	38.5 in	51
43.55	Munich-Nuremberg	1	123.4 in	170

The authorized maximum speed is 55.9 m.p.h., the greatest average speed is 47.52 m.p.h. (Munich-Gunzenhausen), and the longest run without a stop is 123.4 miles (Munich-Nuremberg).

Saxony State Railways.

Average speed, m.p.h.	Run.	Distance and time. No. of trains.	Miles.	Min-utes.
43.50	Altenburg-Leipzig	1	23.9 in	33
42.78	Leipzig-Dresden	1	72 in	101
42.30	Riesa-Leipzig	1	40.9 in	58
41.79	Reichenbach-Leipzig	1	56.4 in	81

The authorized maximum speed is 49.7 m.p.h., the greatest average speed is 43.50 m.p.h. (Altenburg-Leipzig), and the longest run without a stop is 72.1 miles (Plauen to Leipzig).

Wurtemberg State Railways.

Average speed, m.p.h.	Run.	Distance and time. No. of trains.	Miles.	Min-utes.
40.11	Ulm-Aulendorf	1	38.8 in	58
39.73	Ulm-Biberach	3	23.2 in	35
38.66	Pforzheim-Stuttgart	1	36.7 in	57

The authorized maximum speed is 46.6 m.p.h., the greatest average speed is 40.11 m.p.h., and the longest run without a stop is 62.8 miles, from Stuttgart to Crailsheim.

Alsace-Lorraine Railways.

Average speed, m.p.h.	Run.	Distance and time. No. of trains.	Miles.	Min-utes.
47.81	Colmar-Strasburg	1	40.6 in	51
47.37	Strasburg-Schlettstadt	2	26.8 in	34
44.02	Strasburg-Lauterburg	1	34.5 in	47
41.32	Strasburg-Neustadt	1	69.0 in	97

The authorized maximum speed is 55.9 m.p.h., the greatest average speed is 47.81 m.p.h. (Colmar-Strasburg), and the longest run without a stop is 69 miles (Strasburg-Neustadt).

Baden State Railways.

Average speed, m.p.h.	Run.	Distance and time. No. of trains.	Miles.	Min-utes.
49.90	Fribourg-Offenburg	1	39.1 in	47
49.53	Fribourg-Carlsruhe	1	84.2 in	102
49.13	Fribourg-Dinglingen	1	27.8 in	34
48.15	Carlsruhe-Mannheim	2	37.7 in	47
47.72	Appenweier-Oos	8	19.9 in	25
47.46	Schwetzingen-Carlsruhe	3	29.3 in	37
47.01	Fribourg-Mulheim	2	18.0 in	23
46.73	Carlsruhe-Offenburg	1	45.2 in	58
46.72	Oos-Offenburg	5	24.9 in	32

The authorized maximum speed is 55.9 m.p.h.; the greatest average speed is 49.9 m.p.h. (Fribourg-Offenburg), and the longest run without a stop is 84.2 miles (Fribourg-Carlsruhe).

Mecklenburg State Railways.

Average speed, m.p.h.	Run.	Distance and time. No. of trains.	Miles.	Min-utes.
40.22	Waren-Lalendorf	2	22.1 in	32
40.12	Grevesmuhlen-Kleinen	1	14.0 in	21
37.57	Waren-Gustrow	1	31.9 in	51

The authorized maximum speed is 49.7 m.p.h., the greatest average speed is 40.22 m.p.h. (Waren-Lalendorf), and the longest run without a stop is 31.9 miles (Waren-Gustrow).

Palatine Railways.

Average speed, m.p.h.	Run.	Distance and time. No. of trains.	Miles.	Min-utes.
44.27	Wissembourg-Landau	1	17.7 in	24
43.03	Strasburg-Landau	1	59.5 in	83
41.32	Strasburg-Neustadt	1	69.0 in	97

The authorized maximum speed is 55.9 m.p.h., the greatest average speed is 44.27 m.p.h. (Wissembourg-Landau), and the longest run without a stop is 44.7 miles (Neustadt-Munster).

Oldenburg State Railways.

Average speed, m.p.h.	Run.	Distance and time. No. of trains.	Miles.	Min-utes.
37.28	Oldenburg-Leer	1	34.2 in	55
36.92	Delmenhorst-Oldenburg	1	19.1 in	31

The authorized maximum speed is 55.9 m.p.h., the greatest average speed is 37.28 m.p.h. (Oldenburg-Leer), and the longest run without a stop is 34.2 miles (Oldenburg-Leer).

Mein-Neckar Railway.

Average speed, m.p.h.	Run.	Distance and time. No. of trains.	Miles.	Min-utes.
43.52	Heidelberg-Darmstadt	1	37.7 in	52
39.15	Darmstadt-Frankfort-on-Mein	2	17.0 in	26

The authorized maximum speed is 55.9 m.p.h., the greatest average speed is 43.52 m.p.h. (Heidelberg-Darmstadt), and the longest run without a stop is 37.7 miles (Heidelburg-Darmstadt).

It will be seen from the above tables that in no case is the maximum allowable speed of 55.9 miles an hour, under the old ruling, attained. The nearest approach to this figure is on the Prussian State with a speed of 53.0 m.p.h. There are 49 runs scheduled at speeds of 46.6 m.p.h. or better, including all the German roads.

The fastest trains in Germany are run on the Prussian State Railways, which cover the great plain of North Germany. This region allows of long straight lines and easy grades such as are not possible in South Germany because of the broken and mountainous country. The Baden Railroad is situated in the valley of the Upper Rhine in a comparatively level region, and is thus enabled to make almost as good time as the Prussian State. Part of its line, however, traverses the Black Forest, and some of the expresses are run over this line at a speed of 40.4 m.p.h. notwithstanding grades of 1 in 50 and numerous curves.

There are few opportunities for making long runs without a stop in such a populous country, so that their record in this respect can hardly be compared to that of other countries. Below are given some of the longest runs.

Administration.	Run.	Length, miles.	Time, min-utes.	Av'ge speed, m.p.h.
Bavarian	Munich-Nuremberg	123.7	170	43.55
Prussian	Berlin-Leipzig	107.5	135	47.70
Baden	Fribourg-Carlsruhe	84.5	102	49.53
Alsace-Lorraine	Neustadt-Strasburg	70.8	99	43.01

The express service is perhaps not so fast as in other countries but it excels in frequency. On the Oberhausen-Cologne line of the Prussian, for instance, there are from 15 to 20 expresses each way a day, and on the Carlsruhe-Offenburg line of the Baden, there are 20 to 24 expresses in each direction.

The Miller Cab Signal on the New York Central.

The Miller locomotive cab signal is now in use on the "Harlem line" of the New York Central & Hudson River road, from the Harlem River at 133d street, New York City, southward to 55th street, a distance of about four miles. This is a four-track line and is traversed by the passenger trains of the New York Central & Hudson River and the main line of the New York, New Haven & Hartford, 500 to 600 trains a day altogether. The line is equipped with controlled manual block signals, the block sections being between 3,000 ft. and 4,000 ft. long. In the tunnel from 56th street to 98th street, two miles, the visual roadside signals are disks, turning on vertical spindles; north of the tunnel semaphores are used. All of the signals in the tunnel are duplicated; one on the right and one on the left of each track at each point. The home signals, except those which have to be set between the two inner tracks, are fixed at about the height of the engineman's eye as he stands in the cab; but the distant signals are low, and both home and distant, where set between the tracks, are low enough to clear the steps of passenger cars. In the tunnel, the controlling apparatus for the manual signals is provided with track circuits throughout the length of the respective block sections, and these track circuits are so divided as to make an overlap of 800 ft. for each section. That is to say, the minimum distance between trains following one another is the length of a block section plus 800 ft. added at the outgoing end. For high speed trains the minimum space interval must, therefore, be the length of the block section plus 800 ft., plus the distance from the home signal back to the corresponding distant signal.

The track circuits are therefore broken up into at least three sections for each block section, and the Miller signals, though mostly worked by wire circuits, are controlled also by the track circuits. There are, in all, 58 "stations" of the Miller system. The Miller indications are auxiliary to the roadside signal system, and the relays of the latter are used, where convenient, to actuate the Miller apparatus.

The Miller cab signal was described in the *Railroad Gazette* of Feb. 21, 1902. The indication in the cab is given by a red or a white incandescent electric light, and also by a miniature semaphore which is worked by the relay. A dry battery is carried on the engine to energize the relay, and a dynamo, worked by a steam turbine, is used to energize the signal lights.

The roadside apparatus has been in course of construction for several months. The New York Central has 14 locomotives equipped and has now decided to equip 83 more. This will make possible the use of the cab signals

on all of the Central's trains which pass through the tunnel. The motors will also furnish current for 32-candle-power incandescent electric light in the headlights of the locomotives. The New York, New Haven & Hartford runs about 60 locomotives through the tunnel, and it is expected that these also will soon be equipped.

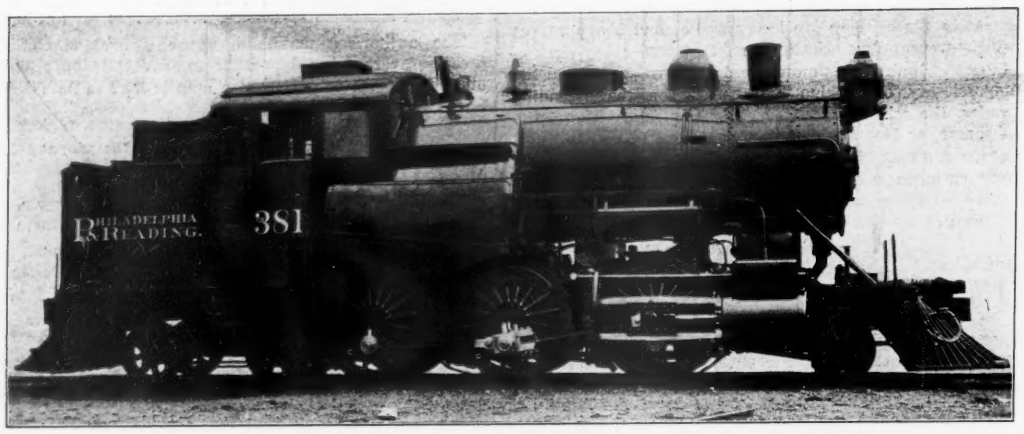
The regulations for the use of the cab signals are in substance as follows:

When leaving Mott Haven Junction southbound, and the Grand Central Station northbound, engineers of engines equipped with the cab signal will start the dynamo and set the direction switch in the north or south position, whichever the case may be. The cab signal will immediately indicate red and remain red until passing 55th street northbound and distant signals at 133d street southbound.

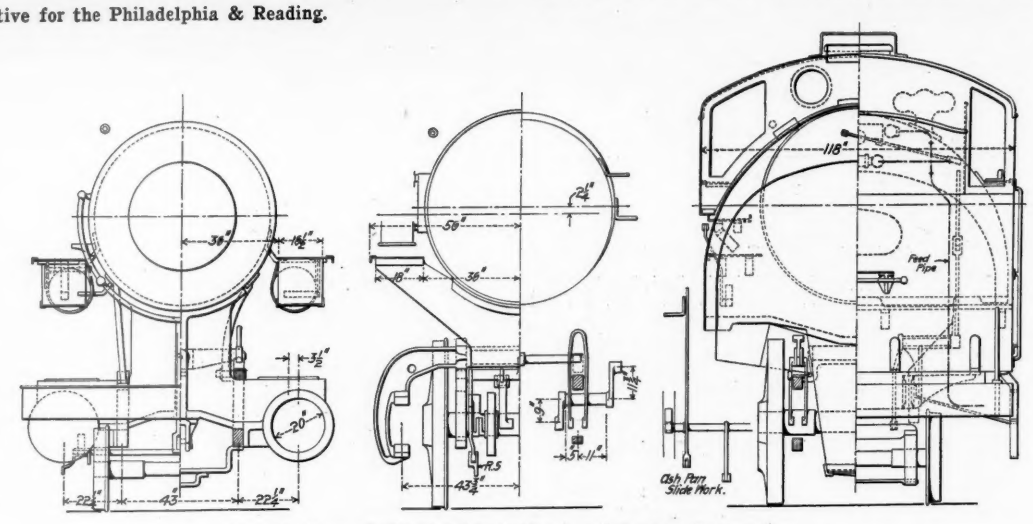
Whenever passing these points, provided the fixed signals indicate proceed, the cab signal will change from red to white and remain white to the next distant signal. If this distant signal is clear the cab signal will remain white, but if the distant signal should be at caution the cab signal will change to red, indicating that the home signal is at danger. If, when passing a distant signal indicating proceed, the cab signal remains white, engineers will continue expecting to find the home signal clear. If, however, the cab signal turns red the engineer will immediately bring his train under control and be prepared to stop at the home signal. In the meantime should the engineer see that the home signal has cleared he will proceed without stopping. When passing the home signal the cab signal will change from red to white, provided the block in advance is clear.

Should the cab signal at any time show red after passing a fixed home signal indicating proceed, the engineer must run with great caution to the next fixed signal. If no obstruction is found on track and the next fixed signal indicates proceed, the engineer will continue, reporting the failure of the cab signal. . . .

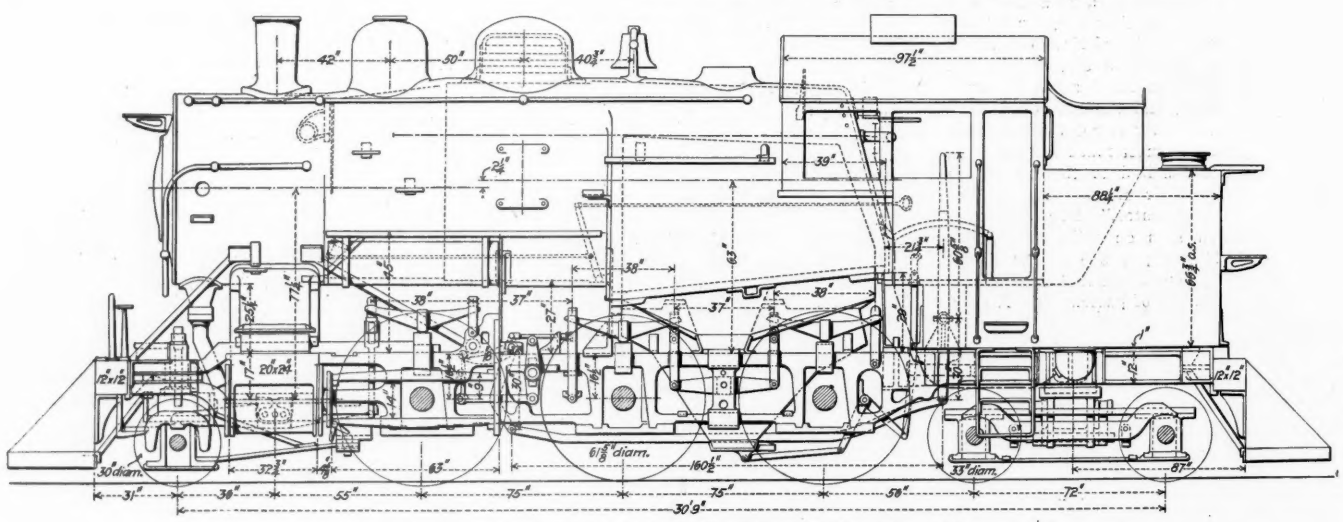
The direction switch must indicate direction engine is headed; for example, engine headed north, running north, or engine headed north running south, switch should indicate "north."



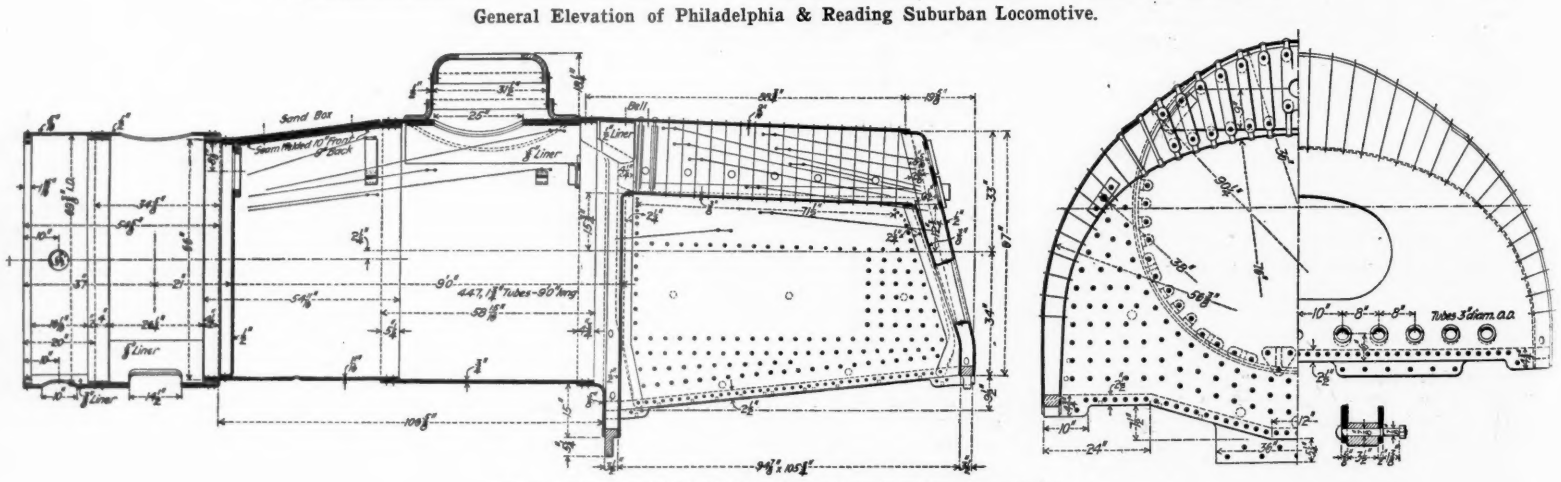
Heavy Double-End Suburban Locomotive for the Philadelphia & Reading.



Cross Sections of Philadelphia & Reading Suburban Locomotive.



General Elevation of Philadelphia & Reading Suburban Locomotive.



Boiler Details of Philadelphia & Reading Suburban Locomotive.

The British Uganda Railroad, 584 miles long from the Indian Ocean to the north end of the Victoria Nyanza lake, earned at the rate $3,580 per mile in 1903, all but $185 of which was absorbed by the working expenses. The road was not opened through until 15 days after the close of the year; but it is not safe to count on an increase in earnings as a consequence; for a large part of the earnings before completion were from the hauling of construction material—about one-fifth in 1901; and another large part, doubtless, was from supplies for the large working force. The number of passengers in 1901 was 99,466; of tons of freight, 184,116. But the road was not expected to yield a profit for years to come. Wood was substituted for coal as locomotive fuel. There is wood on the line: coal must be imported.

Heavy Suburban Locomotives for the Philadelphia & Reading.

The Philadelphia & Reading has received from the Baldwin Locomotive Works six heavy double-end suburban locomotives for use on the Germantown division. They have a 2-6-4 wheel arrangement, wide fire-boxes, and, in point of weight, are second only to the heavy double-enders of the New York Central described in the *Railroad Gazette* March 28, 1902, which weigh 216,000 lbs., with 128,000 lbs. on drivers. The Reading engines weigh 201,700 lbs., with 120,860 lbs., or approximately 60 per cent., on drivers. The cylinders are 20 in. x 24 in., and with 200 lbs. boiler pressure can exert a tractive effort of 26,500 lbs.

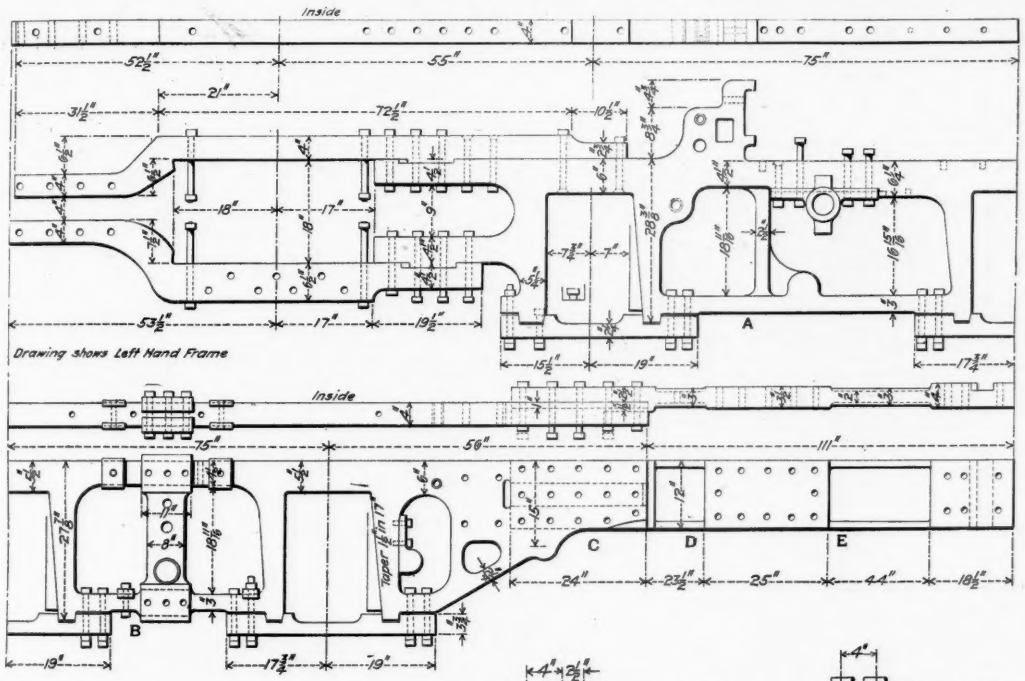
The boiler is designed to burn buckwheat anthracite coal and has a grate area of 68½ sq. ft. The heating surface is 1,981.8 sq. ft., 156.3 sq. ft., or approximately 8 per cent., of which is in the fire-box; an unusually high percentage for wide fire-box engines. The boiler is quite short, the tubes being only 9 ft. Reduced length is compensated for by numbers, there being 447, 1¾-in. tubes.

The diameter of the boiler is 66 in., the amount of its area occupied by the tubes being 41 per cent.

The valve-gear has an unusual arrangement. The reverse-lever rod is beneath the axles, requiring an inverted reverse-shaft arm, which is also offset to avoid interference with the lower rocker arm. The rock-shaft is set back of the links, each of which is connected to it by a rod supported by a right-angled arm from a pin secured to the frame.

The ash-pan is extended outside of the frame on each side. These extensions have draft openings in the sides covered with netting, and small cleaning doors which can be seen in the half-tone. The mud-ring is of peculiar section at the front to enable it to be bolted to a special form of cross-tie. Ten air-inlet tubes 3 in. in diameter pass through the back water space 6 in. from the bottom of the sheets. The injector check is placed on the back head of the boiler, with the delivery pipe inside. The smoke-arch has an extra pair of braces, which run back to the frame. There is capacity for 3,000 gals. of water and 7,500 lbs. of coal. Important dimensions not previously given are as follows:

Weight on drivers	120,860 lbs.
Weight on front truck	19,120 lbs.
Weight on rear truck	61,720 lbs.
Weight, total	201,700 lbs.
Wheel base, driving	12 ft. 6 in.
Wheel base, rigid	12 ft. 6 in.
Wheel base, total	30 ft. 9 in.
Heating surface, fire-box	156.3 sq. ft.
Heating surface, tubes	1825.5 sq. ft.



Frame Details, Philadelphia & Reading Suburban Locomotive.

Heating surface, total	1981.8 sq. ft.
Grate area	68.5 sq. ft.
Drivers, number	6
Drivers, diameter	61⅝ in.
Truck wheels, front, diameter	30 in.
Truck wheels, rear, diameter	33 in.
Journals, driving axle, size	8½ in. x 12 in.
Journals, truck, size	6 in. x 12 in.
Valves, kind of	Balanced
Boiler, type of	Wagon-top
Boiler, working steam pressure	200 lbs.
Boiler, thickness of material in barrel	11/16 in. and ¾ in.
Thickness of tube sheets	½ in.
Thickness of crown sheet	⅜ in.
Crown sheet stayed with	Radial stays
Fire-box, length	94 in.
Fire-box, width	105 in.
Fire-box, depth front	59¼ in.
Fire-box, depth back	46¾ in.
Fire-box, thickness of sheets	⅜ in.
Fire-box, water space, width: Front, 3½ in.; sides, 3½ in.; back, 3½ in.	

Acceleration Tests on the Great Eastern of England.

The following detailed account of tests made with the new 10-coupled suburban tank engine on the Great Eastern of England has been obtained through the courtesy of Mr. James Holden, Locomotive Superintendent. A considerable description of this locomotive was given in the *Railroad Gazette*, Feb. 27, 1903, but for the purposes of this article the following table of principal dimensions is given:

Cylinders, in. (three simple)	18½ x 24
Diameter of drivers, in	54
Heating surface, sq. ft	3,010
Grate area, sq. ft	42
Boiler pressure, lbs	200

The engine was designed to start from rest a "wide" suburban train of 18 four-wheel coaches fully loaded, and attain a speed of 30 miles an hour in 30 seconds after starting, which is equivalent to a uniform acceleration of 1.46 ft. per second per second.

The experimental runs were made on the through line near Chadwell Heath. A series of electrical contacts were placed along the track for a distance of 1,350 ft. and the engine was fitted with two brushes, A and B (see Fig. 1). As the engine passed each contact, the circuit through the electro-magnet, C, was completed and the pencil drew a line on the moving paper ribbon. The ribbon moved at a uniform rate over the roll, and a seconds pendulum was arranged so as to record half-seconds on the paper ribbon as shown by the diagram. The contacts along the track were spaced so that the breaks in the line drawn upon the ribbon would be a uniform distance apart, and hence it could be seen at a glance if the rate of acceleration was uniform. From the known distance between contacts and from the time required to pass from one contact to another, the acceleration in feet per second per second was calculated. The average results of nine trips on April 26, 1903, with a gross load of 320 long tons are shown by the diagram, Fig. 2. The total distance traveled was 660 ft. in 29.9 seconds, which is equivalent to a speed of 30 miles an hour in 29.9 seconds. The details of the recording apparatus were designed by Mr. Hollins, Telegraph Superintendent.

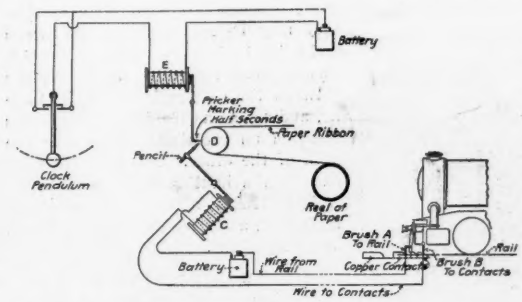
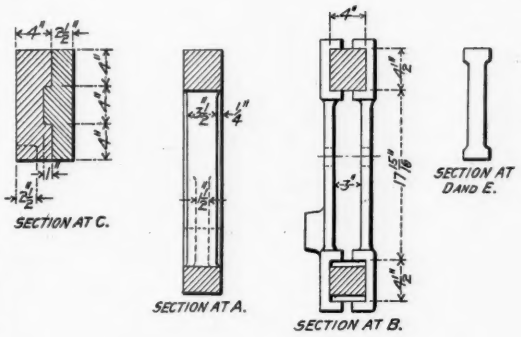


Fig. 1.—Diagram of Electrical Apparatus Used in Acceleration Tests on the Great Eastern.



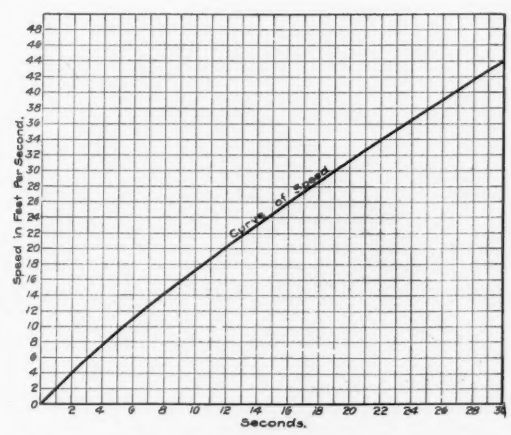


Fig. 2.—Results of Acceleration Tests on the Great Eastern.

(Gross load, 320 tons.)

In view of this remarkable performance, it is interesting to analyze the action of the locomotive during the period of accelerating, say at speeds of 5, 10, 20 and 30 m. p. h. respectively. The total resistance which must be overcome by the locomotive on a level track is composed of two factors, (1) the train resistance (caused by journal friction, air resistance, rolling friction, etc.), (2) the resistance due to increase of speed, or acceleration. The train resistance at various speeds has been determined by numerous experimenters and is necessarily influenced by the type of cars and condition of the rail; but for the present purpose C. E. Wolff's formula will be used, which for speeds up to 30 miles an hour gives the following:

Speed.	Train resistance. lbs. per ton.
0	12.0
5	6.5
10	5.4
15	5.2
20	5.5
25	6.0
30	6.8

The total train resistance for the gross load of 320 tons at speeds of 5, 10, 20 and 30 m. p. h. is 2,080 lbs., 1,728 lbs., 1,760 lbs., and 2,176 lbs. respectively. It is assumed, of course, that the resistance of the locomotive per ton is the same as that of the coaches—which assumption is not strictly correct.

The force required to accelerate a given mass is expressed by the formula $F = \frac{W a}{32.2}$ in which "F" is the force in pounds, "W" is the weight of the mass in pounds, and "a" is the acceleration in ft. per sec. per sec. From the diagram (Fig. 2) the acceleration at 5, 10, 20 and 30 m. p. h. is found to be 2, 1.8, 1.3 and 1.25 ft. per sec. per sec. respectively. By substituting these values in the above formula the accelerating force at 5, 10, 20 and 30 m. p. h. is found to be 44,600 lbs., 40,100 lbs., 28,900 lbs., and 27,800 lbs. respectively. To these values should be added the force necessary to accelerate the rotating parts of the cars and locomotives, but in the absence of exact data concerning the weights and dimensions of these parts, this factor will be neglected. The following table is a summary of all the above calculations:

Speed, M.P.H.	Time from starting, sec.	Train resistance, lbs.	Accelerating force, lbs.	Total resistance, lbs.
5	3.7	2,080	44,600	46,680
10	8.2	1,728	40,100	41.828
20	18.7	1,760	28,900	30,660
30	29.9	2,176	27,800	29,976

The engine has three simple cylinders and hence the formula for tractive effort is $\frac{3}{2}\frac{p\,l\,d^2}{D}$ in which "p" is mean effective pressure in lbs., "l" is the stroke in inches, "d" is the diameter of the cylinder in inches and "D" is the diameter of the drivers in inches. In this equation all factors are fixed except "p" (the mean effective pressure) which varies with the speed and cut-off. An indicator diagram taken shortly after starting is shown in Fig. 3. This diagram shows that the mean effective pressure was 94 per cent. of the boiler pressure. During the tests the boiler pressure varied from 205 to 210 lbs. per sq. in. so that the mean effective pressure was about 195 lbs. at starting. Substituting in the formula for tractive effort gives:

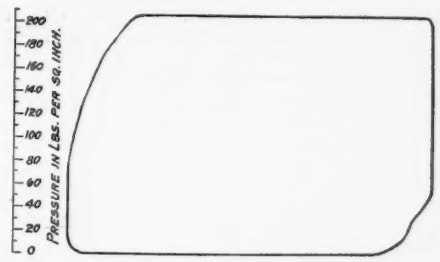


Fig. 3.—Indicator Diagram from Great Eastern Decapod.

$$T \text{ (tractive effort)} = \frac{(18.5)^2 \times 195 \times 24 \times 3}{54 \times 2}$$

$$= 44{,}500 \text{ lbs.}$$

It will be noted that the maximum tractive effort of 44,500 lbs. is several thousand pounds less than the force shown to be necessary to produce the given acceleration at starting, but this discrepancy can be accounted for by errors in the assumed value of the resistance and by the fact that at starting the engine has advantage of the slack in the train to increase the cylinder power due to the slight momentum gained. Immediately after starting the cylinder tractive effort exceeds the required force. This performance indicates that the engine is well designed, especially as regards cylinder and valve proportions. The high mean effective pressure realized in these tests exceeds that usually obtained in practice. During the first experiments trouble was experienced by the priming of the boiler, but this was soon overcome by modifying the arrangement of the steam pipe.

Norfolk & Western Yard Improvements.

BY GEO. L. FOWLER.

In the two articles already published (*Railroad Gazette*, July 3, and 24) on the physical condition and terminal facilities of the Norfolk & Western, allusion was made to the extensive improvements that are now being made in new yards and the betterment of the alinement and grades of the mountain sections of the road. This article shows in brief outline the work that has been undertaken and the principles of construction that have served as a guide for the laying out of the yards. At the present time there are four yards in course of construction, or arranged for. They are at Bluefield, W. Va.; East Portsmouth, Ohio; Roanoke, Va., and Williamson, W. Va. This may be considered as the order of the magnitude of the several undertakings.

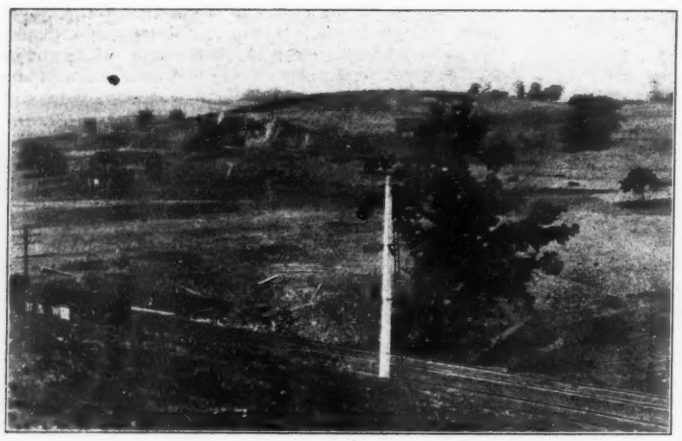


Fig. 1.—Excavating and Grading for Roanoke Yard.

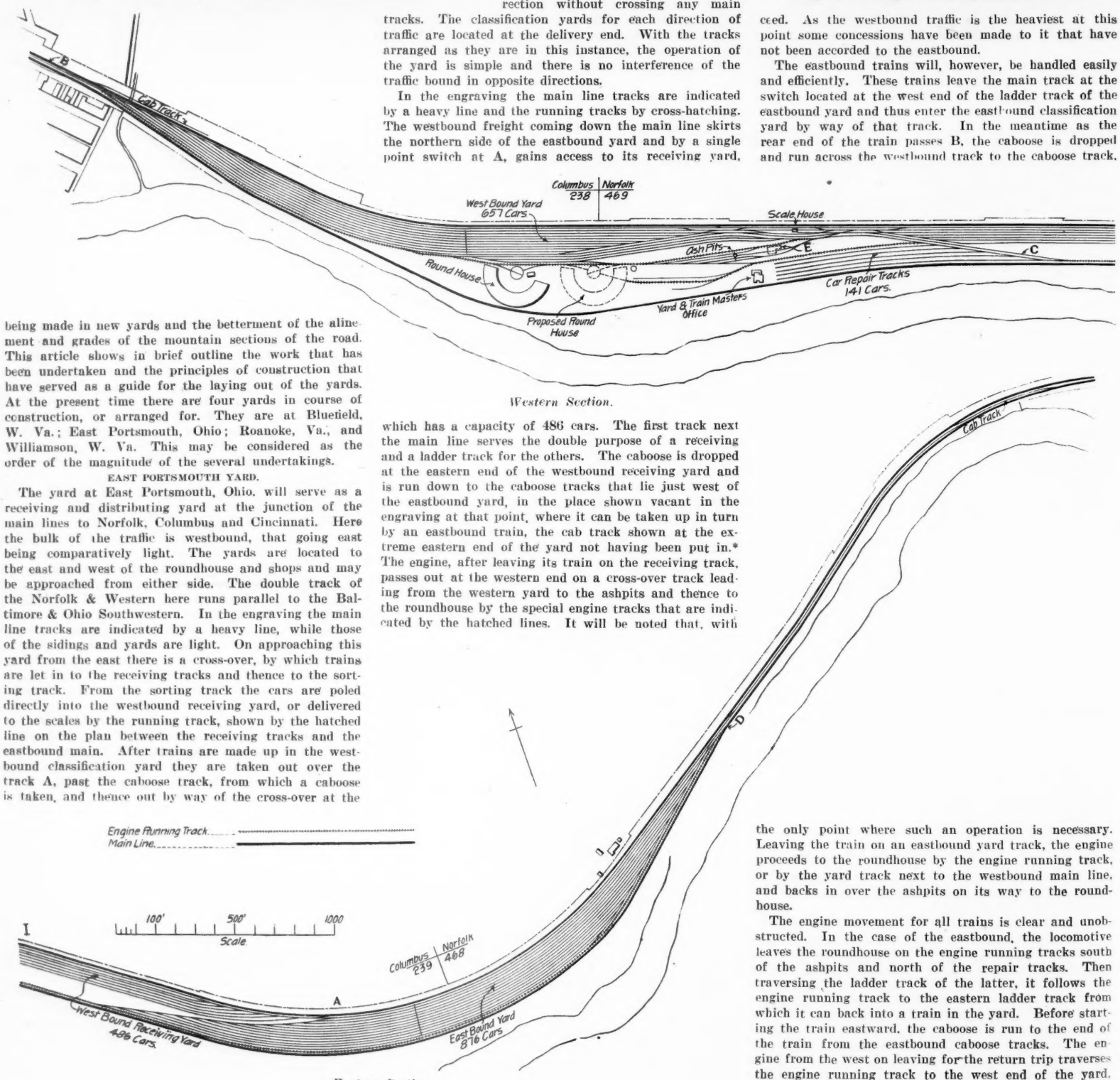
EAST PORTSMOUTH YARD.

The yard at East Portsmouth, Ohio, will serve as a receiving and distributing yard at the junction of the main lines to Norfolk, Columbus and Cincinnati. Here the bulk of the traffic is westbound, that going east being comparatively light. The yards are located to the east and west of the roundhouse and shops and may be approached from either side. The double track of the Norfolk & Western here runs parallel to the Baltimore & Ohio Southwestern. In the engraving the main line tracks are indicated by a heavy line, while those of the sidings and yards are light. On approaching this yard from the east there is a cross-over, by which trains are let in to the receiving tracks and thence to the sorting track. From the sorting track the cars are poled directly into the westbound receiving yard, or delivered to the scales by the running track, shown by the hatched line on the plan between the receiving tracks and the eastbound main. After trains are made up in the westbound classification yard they are taken out over the track A, past the caboose track, from which a caboose is taken, and thence out by way of the cross-over at the east end of the eastbound yard to the main line. Engines bringing their trains to the receiving tracks or taking their trains from the classification yard have convenient movement to and from the roundhouse and to coal, sand and water. The eastbound traffic is handled in identically the same way, and the arrangement of the tracks is the same with the exception that the trains, after having been made up, are carried along the outer side of the westbound yard and do not reach the main line until they have passed beyond the extreme limits of the sorting and poling tracks of the westbound traffic. Provision is made for weighing cars between the two yards so that they may be run out over the scales and poled back as required. With this arrangement there is no interference between the east and westbound traffic, and as far as the freight work goes there is no crossing of one over the path of the other. The only interference is the hauling of the westbound freight trains across the eastbound main line, a matter that, at this point, is unimportant.

WILLIAMSON YARD.

Another important yard is formed by the enlargement designed for the present one at Williamson, W. Va., situated at the western end of the Pocahontas coal fields, and to which much of the coal traffic is directly tributary. This yard like that at Roanoke, as will be seen later, is laid out between the tracks of the main line so that it can be entered from either direction without crossing any main tracks. The classification yards for each direction of traffic are located at the delivery end. With the tracks arranged as they are in this instance, the operation of the yard is simple and there is no interference of the traffic bound in opposite directions.

In the engraving the main line tracks are indicated by a heavy line and the running tracks by cross-hatching. The westbound freight coming down the main line skirts the northern side of the eastbound yard and by a single point switch at A, gains access to its receiving yard, which has a capacity of 486 cars. The first track next the main line serves the double purpose of a receiving and a ladder track for the others. The caboose is dropped at the eastern end of the westbound receiving yard and is run down to the caboose tracks that lie just west of the eastbound yard, in the place shown vacant in the engraving at that point, where it can be taken up in turn by an eastbound train, the cab track shown at the extreme eastern end of the yard not having been put in.* The engine, after leaving its train on the receiving track, passes out at the western end on a cross-over track leading from the western yard to the ashpits and thence to the roundhouse by the special engine tracks that are indicated by the hatched lines. It will be noted that, with the proposed roundhouse, these tracks are so arranged that the engines, moving in opposite directions for the incoming westbound and the outgoing eastbound trains, do not interfere with each other in any way.



Western Section.

Eastern Section.

Williamson, W. Va., Yard of the Norfolk & Western.

After the train has been left in the westbound receiving yard any track may be cleared and the cars hauled past the scalehouse and thence on to the ladder track of the classification yard. This westbound classification yard has a capacity of 657 cars. When the trains are made up in this yard the engine leaves the roundhouse over the engine running tracks that are shown by hatched lines, and skirting the eastbound receiving yard, backs into the train that is awaiting it. The train is pulled out on the westbound main track over the trailing switch at B, and after it has cleared it, the caboose is run down from the caboose track and the train is ready to proceed. As the westbound traffic is the heaviest at this point some concessions have been made to it that have not been accorded to the eastbound.

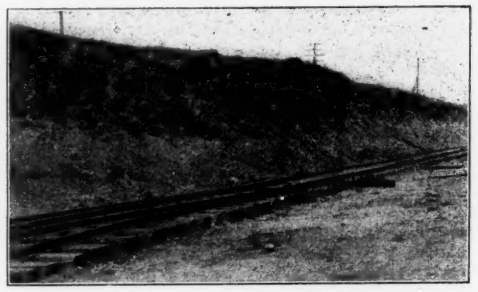


Fig. 2.—Cutting in Grading Roanoke Yard.

The eastbound trains will, however, be handled easily and efficiently. These trains leave the main track at the switch located at the west end of the ladder track of the eastbound yard and thus enter the eastbound classification yard by way of that track. In the meantime as the rear end of the train passes B, the caboose is dropped and run across the westbound track to the caboose track, the only point where such an operation is necessary. Leaving the train on an eastbound yard track, the engine proceeds to the roundhouse by the engine running track, or by the yard track next to the westbound main line, and backs in over the ashpits on its way to the roundhouse.

The engine movement for all trains is clear and unobstructed. In the case of the eastbound, the locomotive leaves the roundhouse on the engine running tracks south of the ashpits and north of the repair tracks. Then traversing the ladder track of the latter, it follows the engine running track to the eastern ladder track from which it can back into a train in the yard. Before starting the train eastward, the caboose is run to the end of the train from the eastbound caboose tracks. The engine from the west on leaving for the return trip traverses the engine running track to the west end of the yard, where it picks up its train and caboose as already noted.

The repair tracks, as will be seen from the engraving, are located between the two yards and are convenient to the office of the yardmaster. Access to these tracks is obtained over a ladder track having a direct connection to that of the eastbound classification yard. They may also be entered from either end of the ladder track of the westbound classification yard, though it is more con-

*The engraving was made from the original plan and the changes indicated in the text have been made since that time.

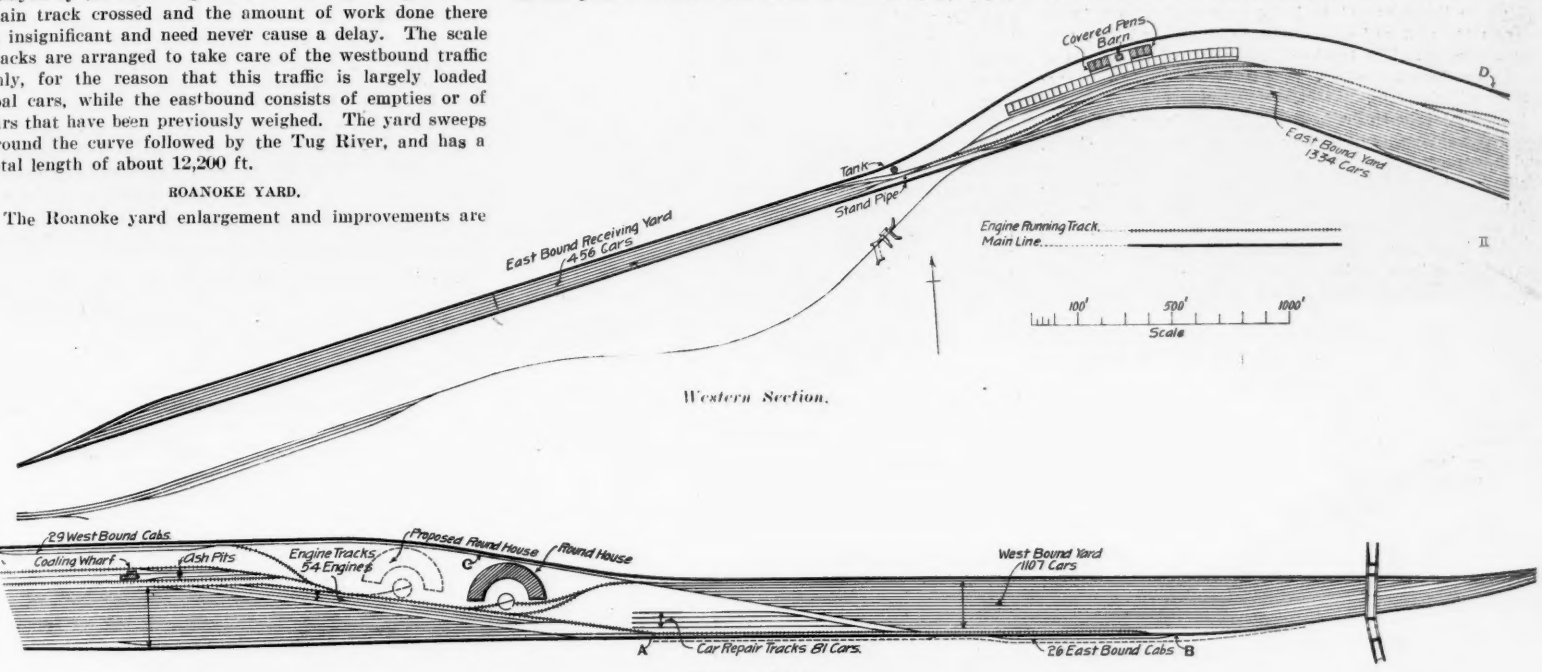
venient to make the movement from the western end of this ladder. The cars are hauled back over the track marked 1, which delivers to the engine running track at the west end of the repair ladder whence they are backed into this yard.

It will thus be seen that all of the engines, train and car movements can be effected with the utmost facility and without the slightest interference in any way with the passenger or through traffic on the main lines. There is a free communication between the yards for the handling of cars, and engines can be run to and from their trains without in any way interfering with or being delayed by the switching service. At only one point is a main track crossed and the amount of work done there is insignificant and need never cause a delay. The scale tracks are arranged to take care of the westbound traffic only, for the reason that this traffic is largely loaded coal cars, while the eastbound consists of empties or of cars that have been previously weighed. The yard sweeps around the curve followed by the Tug River, and has a total length of about 12,200 ft.

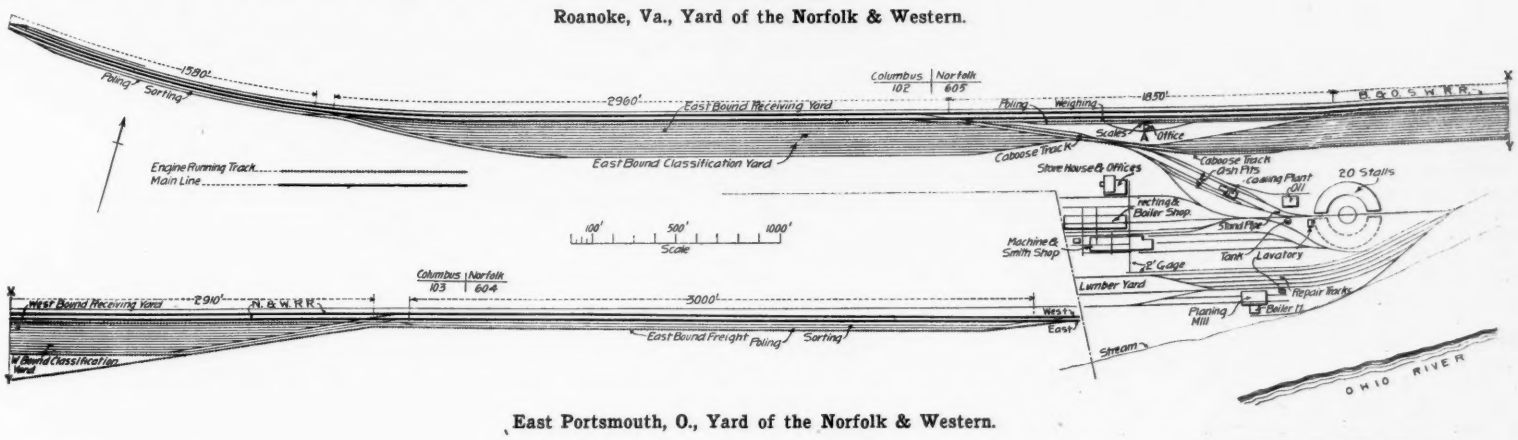
ROANOKE YARD.

The Roanoke yard enlargement and improvements are on the south, as well as a division terminal and the location of the principal shops of the company, it follows that there is a very large amount of yard work to be done there.

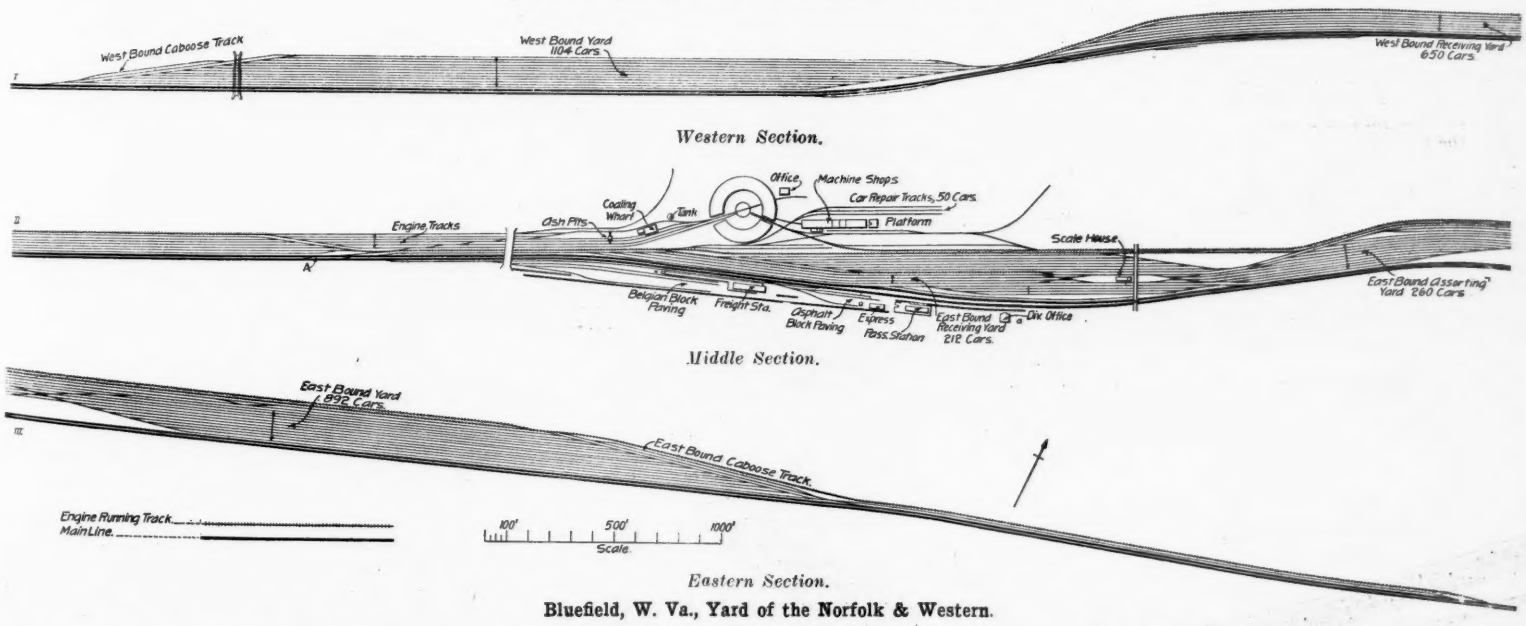
As in the case of the Williamson yard, the one at Roanoke will be placed between the tracks of the main line. It will be situated to the west of the passenger depot and business portion of the city and will have a length of about 13,200 ft., and is being almost entirely rebuilt. The present main line tracks pass through what will be the classification yards, and at the west end of the eastbound yard make a detour to the south as shown on the plan to avoid a hill which is now being cut away at the eastern end over the engine running track indicated by cross hatching, and on to the coaling wharf and asphits and thence to the roundhouses. At this point the cabooses are switched back to the waiting tracks as indicated. This engine running track is entirely separated and distinct from those of the classification yard so that the work in the latter is neither interrupted by nor interrupts the movement of the engines to the roundhouse. The eastbound trains, on leaving the receiving yard, run out over a special track south of the engine running track and thence on to the ladder track of the classification yard, which has 16 tracks and a capacity of 1,334 cars. The eastbound engines on leaving the round-



Roanoke, Va., Yard of the Norfolk & Western.



East Portsmouth, O., Yard of the Norfolk & Western.



Bluefield, W. Va., Yard of the Norfolk & Western.

extensive and the new yard is laid out in the same general way as that at Williamson with a few modifications adapting it to the locality. At Williamson, provision had to be made for the reception, sorting, weighing and distribution of traffic gathered near at hand and brought in from a miscellaneous number of shippers and consigned to almost as many different points, the movement of the traffic being principally westbound. At Roanoke this traffic is eastbound and has, for the most part, been weighed and sorted. Roanoke being the junction of the through lines between the east and west, and the Shenandoah line to Hagerstown on the north and Winston-Salem to make room for the eastbound receiving yard. The nature of the work of excavation is shown in Fig. 1, where the machinery may be seen at work on the hill in the background. Fig. 2 shows the nature of the work being done along the south side of the eastbound classification yard. The total amount of the excavation needed for the completion of the yard is about 500,000 cu. yds.

The eastbound traffic being the more important of the two, the yards devoted to it are the largest. Trains arriving from the west run in on the ladder track at the west end of the eastbound receiving yard, which has a capacity for 456 cars. The engine and caboose pass out house run out on the engine running tracks to the point A, where they back into the yard for their train, hauling it down to the point B, alongside the westbound yard, where the caboose is attached and the trains made ready to proceed. At the east end of the yard and opposite the roundhouse there are three engine standing tracks with a capacity of 54 engines. Beyond this to the east there is a repair yard with a capacity of 81 cars, that is entered from the western ladder track of the westbound yard.

The westbound traffic, which is here the light movement, is cared for by a combination receiving and classification yard having a capacity of 1,107 cars. The trains

leave the main line at the entrance to the yard and, moving over the ladder track to one of the 16 tracks forming the yard, are left to be sorted while the engine and caboose are sent out on to the ladder at the west end. The caboose is, then, dropped back to the eastbound caboose track, and here the one crossing of the main line is made. The engine passes out over the engine running tracks to the ashpits and the coal wharf and thence back to the engine sidings or roundhouse. When a westbound train has been made up in the classification yard, the engine takes it and, hauling it over the track C, south of the westbound main line, reaches the latter at D, where the caboose is coupled on and the train made ready to proceed, or the switching engine may take it out on to this track C, and the road engine back in on it from the east end of the caboose track, and then proceed as before. The tracks at the north of the west end of the eastbound yard are to serve stock yards that are located at this place.

The yard is entirely free and independent of that devoted to passenger service as well as of that of the shops, and is expected to be able to handle not only the present traffic but to take care of the normal growth for a number of years to come. It is located on a hard shale soil, that can be handled with steam shovels so that, in spite of the large amount of material to be moved, rapid progress has been made.

BLUEFIELD YARD.

The fourth yard extension arranged for is the largest and the most important of all. It has a total length of about 21,100 ft. and is situated at Bluefield, West Virginia, on the edge of, and at the eastern outlet of the coal fields and is the point where large amounts of coal are delivered from the mines for shipment. The principles that have been worked out so successfully in the Williamson and Roanoke yards of placing them between the main line track have, of necessity, been abandoned here on account of the configuration of the ground and the requirements of local conditions. Both east and westbound yards are here placed on the north side of the tracks, and a number of other important modifications have been introduced, especially in the eastbound yards, and in this case also both east and westbound yards are operated by gravity. The respective yards are located at the delivery ends, and are situated on either side of the roundhouse and shops. The main line tracks are indicated, as in the other engravings, by heavy and the running tracks by hatched lines.

The westbound traffic leaves the main track at the extreme eastern end of the yard and passes along over a special westbound freight running track. This track lies along the northern side of the eastbound yards, and between the engine tracks and the entrance to the eastbound receiving yard with a connection to the ladder track of its own receiving yard. In order, however, that the incoming caboose may be conveniently located for the return trip on an eastbound train, it is dropped off at the eastern end of the eastbound yard at the point indicated for caboose tracks.

At the westbound receiving yard the engine passes out at the west end, and returns to the engine house over the engine running tracks on the north side of the yard. The western ladder track for these is separated from that of the receiving yard and all are served by one track common to both and to the ashpits. From the ashpits, there is a straight run to the coaling wharf, the water tank and the roundhouse. From the receiving yard, which has a capacity of 650 cars, to the classification yard, the capacity of which is 1,104 cars, there is a direct and easy gravity movement, as will be seen from an examination of the plan. For outgoing westbound trains there are two routes which the engine may follow from the roundhouse or storage tracks to the west end of the yard. One is to come out on the ladder track separating the standing tracks from the ashpit tracks, reaching the main westbound track at A, and thence along the latter to the far end of the classification yard, where it can back into its train, and pick up the caboose from the tracks reserved for them. The other route is to follow the engine running track along the north side of the receiving yard and strike the main westbound track between the two yards. The first route is the one to be preferred as the engine is thus out of the way of those going toward the roundhouse after leaving a train in the receiving yard.

The westbound movement clears the main track at the entrance to the yard, and as it is provided with its own running tracks it does not interfere with nor is it delayed by the work of the eastbound yard. It leaves and enters the main line from the same side and does not cross any of the eastbound traffic or the main lines. In this respect it resembles the Williamson and Roanoke yards.

The handling of the eastbound traffic is more complicated. Provision has to be made for sorting as well as receiving and classification yards because of the large amount of eastbound traffic originating at this point from the mines. The eastbound train hauls its caboose into the receiving yard, where it is dropped and hauled back to the caboose tracks at the west end of the yard. The entrance to the receiving yard is by way of a crossover at A, and a piece of running track between the main line and the westbound running track. This receiving yard has a capacity for 212 cars and delivers direct to the scale tracks whence, by way of a split ladder track the cars are run in to the eastern sorting yard, having a capacity of 260 cars, and thence on to the classification yard, with a capacity of 892 cars, where the trains are finally made up. From the eastern end of the receiving yard the incoming engines reach the roundhouse by way of a running track lying between the receiving yard tracks. On this track the engine reaches the westbound freight running track over which it passes to the storage tracks and ashpits. This causes a minimum of delay to any westbound freight.

In order that there may be no delay to engines moving between the roundhouse and the head of eastbound trains, a special engine running track is provided outside of and to the north of the westbound freight running track. An engine leaving the roundhouse thus skirts the whole of the eastbound yard, and taking its train at the east end, hauls it out on to the middle siding lying between the westbound main, and freight running tracks. Here the caboose is attached and the train hauled across the westbound track to the eastbound track. Even at this point the possibilities of delays are reduced to a minimum, for this eastbound freight traffic crosses the westbound passenger tracks only and in no way interferes with the freight whose path is crossed by the empty eastbound engines only. The same principle of the separation of the tracks to accommodate the yard between them is followed here as in the two previous yards, in that the westbound freight traffic is kept clear of and does not cross the eastbound at all, while its own path is crossed by empty engines only. At the same time the eastbound trains give a minimum of interference to westbound passenger traffic, since the tracks for the latter are crossed only by trains that are either entering a middle siding that is cleared for their reception, or are pulling out prepared for a run over the road.

The track arrangement for eastbound traffic is such that cars can be dropped by gravity from any track in the eastbound receiving yard over either of two track scales where they are automatically weighed and recorded. Then by gravity these cars can be dropped from either scales to any track in the eastbound assorting yard. Here the cars will be grouped into classes and again dropped in cuts by gravity from any track in the assorting yard to any track in the main eastbound yard. A brick scale house 25 ft. by 75 ft. is located between the two track scales, for the accommodation of the clerks and yard men engaged in the weighing of cars. On this building is a switching tower from which an operator can throw by electro-pneumatic apparatus all the switches needed for the assorting of cars just described. An overhead foot and highway bridge makes this scale house and tower accessible from the streets outlying, without the necessity of crossing the tracks of the yard.

The yard at Bluefield is considerably longer than that at Roanoke, and the amount of excavation needed to put it in condition is also greater and largely rock work.

These yards are interesting examples of what can be done in making local conditions subordinate to one general principle of design under a variety of circumstances, and produce in every instance a yard that, if taken by itself and studied independently, would be considered a model of convenience. The basic principle aimed at in all of these yards is to arrange them so that traffic in either direction can enter, be cared for, and leave, and not interfere with that moving in the opposite. This is, of course, most easy where the yard is between the main lines as at Roanoke and Williamson, but it has been shown to be possible to produce practically the same results at East Portsmouth and Bluefield, where the yards are upon one side of the main line, leaving only one of the main line passenger tracks to be crossed by trains entering and leaving the yard in the opposite direction.

New Locomotive Shops at Montreal.

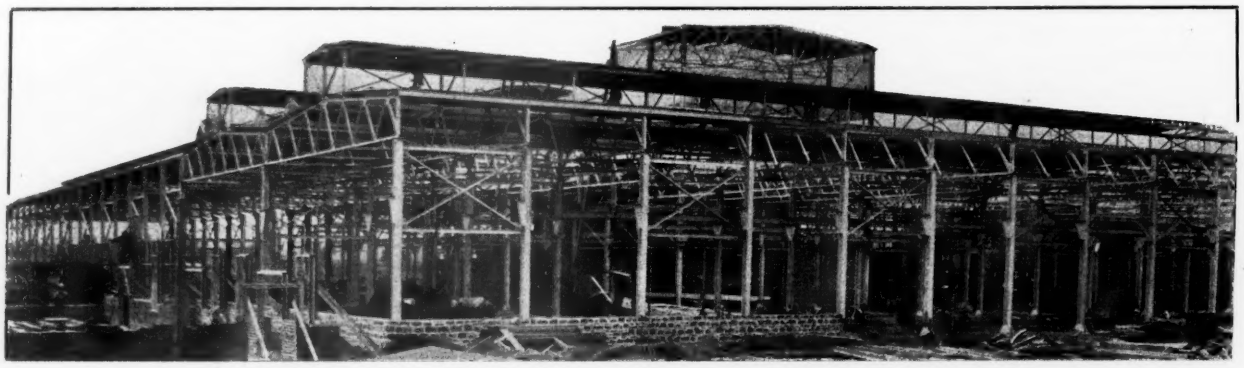
The accompanying illustration from a photograph taken the last week in August, shows the progress up to that time in erecting the steel frame of the shops of the Locomotive & Machine Company of Montreal, Limited, Montreal, Que., and which were described, with drawings, in the *Railroad Gazette* August 21. This is the second commercial locomotive shop to be built in Canada and the new concern has a fine field. The enterprise the management has shown in putting up the buildings and early beginning work, indicates that the field will be well occupied. It is only nine months since the first orders for material and machinery were given.

As before stated, all of the material for the buildings was bought in Europe—different orders being given where the quickest deliveries could be made. All the steel for the buildings was cut and fitted on the ground by the Structural Department of the company. Most of the work had to be done out of doors because the temporary shop was destroyed (in May) by fire. As the machinery for most of the departments began to arrive from Europe, from the United States and Canadian shops simultaneously with the structural material for the buildings, nearly all the large machines were in place before the buildings were covered.

The buildings are now nearly finished. Some of the departments of the works have been organized and the Locomotive Department has been busy all summer in a temporary shop re-building several locomotives and making parts for new ones.

The Structural Department is to be fitted to build steel buildings, roof trusses, turntables and bridges. The shop buildings have all been put up by this department.

In the illustration, the skeleton in the foreground is for the machine shop, 420 ft. x 132 ft., divided into two bays, each with a traveling crane of 62 ft. 8½ in. span.



Steel Framework of the Shops of the Locomotive & Machine Company of Montreal.

The walls of this building as well as all outside walls excepting the power house, will be of steel, stone, brick and glass. The plant will have an annual capacity of 300 locomotives. The locomotive works at Kingston, heretofore the only shops in Canada building locomotives for sale, build only 75 a year.

In considering this new establishment it is interesting to note the number of locomotives sent into Canada from the United States in recent years. The statistics of the United States Government for the year ending June 30, 1902, show that 73 engines, valued at $674,837, were sent to Canada; in 1901, 76 engines valued at $616,862; in 1900, 51 engines valued at $398,623; and in 1899, 50 engines valued at $397,400. As the Locomotive & Machine Company of Montreal will pay particular attention to export trade, the following figures showing the total number of locomotives exported from the United States to all foreign countries are also of interest:

	Number.	Value.
Seven months ending July 31, 1903...	146	$1,519,982
Year ending June 30, 1902.....	365	3,257,894
Year ending June 30, 1901.....	423	4,639,006
Year ending June 30, 1900.....	525	5,592,403
Year ending June 30, 1899.....	517	4,728,748

Water Treatment in Railroad Operation.

An abstract of the paper on this subject read by Mr. G. R. Henderson at the September meeting of the Western Railway Club was given in the *Railroad Gazette* September 18. Extracts from the discussion of this paper follow:

Mr. G. M. Davidson (C. & N. W.).—There are several causes of boiler foaming. First, there may be excess of soda ash. There are two kinds of soda ash on the market known as the "dense" and the "ordinary." Chemically they are the same, physically they are not, the dense being compact and the ordinary being light and fluffy. Sometimes we would get one kind and sometimes another, the consequence being that results are not satisfactory. At De Kalb, Ill., we have water which contains about four grains of soda ash per gallon. Engines leaving Clinton (Iowa) would do well until they got to De Kalb. Analyses of some waters used on the Dakota division show 10 in which the soluble salts are from 86 grains to 121 grains per gallon, most of which is sulphate of soda. We have one water that has 102 grains of sulphate of soda in it, and we have another one that has 89 grains of sulphate of soda in it. The opinion among the operating men and among the engineers is, that the one that has 89 grains of sulphate of soda, foams more than the one with 102 grains. A study of the anal-

ysis shows that the one that has 89 grains in it, has, in addition, 12 grains of soda ash, which proves that soda ash is the cause of much foaming.

Dirty boilers also cause foaming. We found when we first commenced to use treated water that we had a great deal of trouble the first week. After the scale was all out, then our troubles ceased, so far as foaming was concerned.

I have under my supervision 16 plants, and most of them have been in operation a year. We keep a record of the cost of chemicals, fuel, labor, etc. Last month the cost of chemicals per thousand gallons was less than 1 cent in seven of them; in seven others it ran from 1 cent to 2 cents, and in two of them from 2 cents to 2.7 cents.

It is a mistake to go into the water softening business without knowing exactly what you are doing. It is good practice to study each water; not only take a single analysis, but take analyses at different seasons of the year and under different conditions, before a rain storm and after a rain storm.

Mr. Robert Quayle (C. & N. W.).—We have 350 miles of road now, that is, continuous miles of road, over which we run about 200 locomotives that are constantly taking water from these plants. The number of boiler-makers and boiler-makers' helpers has been reduced and engines are going out and coming in without the difficulties formerly encountered.

We are satisfied that the way to treat water is to treat it before it is put into the tanks.

Mr. M. K. Barnum (C., R. I. & P.).—I had about a year's experience on the Union Pacific with the use of a special boiler compound which gave good results in the stationary boilers of the city waterworks at North Platte. The water at that point contained about 28 pounds of solid matter per thousand gallons.

The average amount of compound used was about 8 oz. to a thousand gallons, and it cost about 6 cents a pound, making the cost per thousand gallons about 3 cents. After the plants were once built there was practically no cost for attention, as the pumpers added the compound.

This compound was tried west of North Platte, where the water was worse than that east of North Platte. Boiler work on the engines using the treated water was reduced one-quarter of that still required on engines running east of North Platte which were not using the treated water.

The Rock Island has made a thorough test of soda ash for locomotive boilers with some benefit, but not enough to be satisfactory, and we are now about to install water purifying plants on the Kansas division at 15 different stations.

At one point on that division we have water heavily charged with common table salt, and we have yet to find a chemist that can handle that water by chemical treatment. We have talked with Prof. Goss and have considered the use of a distillation plant, but the question is not yet settled, though that seems to be the only solution of the problem.

Mr. J. A. Carney (C., B. & Q.).—I believe that distillation is the only way waters containing large quantities of sodium salts can be treated successfully.

Mr. G. R. Henderson.—The test with the Goss still was made in Bagdad, Cal., where the water had about 400 grains to the gallon, 233 grains of salt and about 175 grains of chloride of calcium. While the still was merely a model which was made for patent office purposes, yet it demonstrated the fact that the water could be handled.

This water was hauled in the trains 57 miles, and the cost of hauling up to the tank on the hill was 30 cents a thousand gallons; the cost with the distilling plant was 13 cents a thousand gallons, and as the consumption was about 100,000 gal., it made practically $17 a day saving. However, the proposition of piping in the water has been considered, and as that would give a chance of supplying two or three tanks on the way, it will probably be put into effect, although it will cost about $300,000 as against about $40,000 for the still. The $40,000 for the still is about the cost of the locomotive and train used in hauling water.

Trade Union Outrages in August.

The following list of trades union crimes during August has been taken from accounts published in newspapers at the places and times of occurrence:

Lynn, Mass., Aug. 1.—John Franklin Hyle, a boot and shoe workers' cutter, is set upon, brutally beaten, kicked and trampled, and a crowd of 2,500 gather and the police respond to a riot call. Hyle is taken to a hospital, cut, bruised and bleeding.

Richmond, Va., Aug. 1.—The breaking of the street car strike is still characterized by stone throwing at cars and one shot is fired at a car on Beach street.

Richmond, Va., Aug. 2.—A tie and nearly a half bushel of spikes are found on the track of the Seven Pines Railroad and indications are discovered of an attempt to destroy the trestle with dynamite.

Buffalo, N. Y., Aug. 3.—While a number of Italian non-union employees of the Buffalo Union Furnace Company are passing along Ohio street, "scab" is hooted and stones are thrown at them. The Italians, who had previously been working under police protection, draw revolvers and a riot ensues. The next morning the Italians refuse to go to work, their leader saying they believed the police to be in sympathy with the strikers.

McKeesport, Pa., Aug. 6.—Four non-union employees of the Port Une mills are set upon by a crowd of strikers, who fire at a policeman before disappearing.

Chicago, Ill., Aug. 6.—John C. Weller, foreman for E. A. Rysdon's cornice plant, is attacked by four strikers because he refused to join them, crowded into a doorway by a shower of blows and when struck and kicked repeatedly draws his revolver and fires, killing one of his assailants.

New Orleans, La., Aug. 6.—Luke Lalla, who had withdrawn from the Carriage and Wagon Workers' Union and insisted on working as a non-union man, is attacked by four members of the union from which he resigned, knocked down with the spoke of a wheel and severely beaten, but meanwhile manages to draw a revolver and wounds one of his assailants.

Chicago, Ill., Aug. 7.—August Martin, a non-union machinist in the employ of the Fay-Sholes Typewriter Company, is attacked by two union men, knocked down and kicked in the ribs.

Chicago, Ill., Aug. 7.—Donald McDonald Carter, a foreman of the Chicago-Edison Company, is set upon by ten union pickets, who beat him with a slungshot until unconscious.

Philadelphia, Aug. 7.—In protecting three non-union textile workers from assault from strikers, three policemen are required to keep at bay a crowd of over 400 men and boys. Two policemen and six non-union dyers they are escorting to work are attacked by a crowd of 100 strikers and pelted with bricks and stones.

Boston, Mass., Aug. 13.—David Feldman, a non-union workman of the Eastern Skirt Company, is chased by a gang of union lockouts, knocked down and jumped on. When rescued he had a wound in the forehead, a sprained wrist and injured elbow. Two arrests are made.

Benwood, W. Va., Aug. 15.—Striking union machinists attack non-union men who have taken their places at the Wheeling Steel & Iron Company's mills and a riot ensues in which several are injured and which is not dispelled until the county authorities are appealed to.

Taylorsville, N. J., Aug. 17.—Sixty striking Italians attack negroes who are erecting derricks on stone boats, with stones and sticks and order them to quit work.

McKeesport, Pa., Aug. 19.—B. Cleckner, an employee of the Port Une mills, is assaulted by a striker.

Buffalo, N. Y., Aug. 21.—Frank Bulesky, a non-union employee of the Buffalo Union Furnace Company, is assaulted by a striker and badly cut.

Chicago, Ill., Aug. 21.—Samuel Pressler, a non-union tailor, is assaulted and strangled almost to death by union workmen.

McKeesport, Pa., Aug. 21.—Strikers of the Port Une mills try to steal a keg of beer from the non-union workmen. In the ensuing fight bricks are thrown and many badly injured. The wives of the strikers engage in the melee with broomsticks and chase Mrs. Scott, who keeps a strike breaker's boarding house, until she falls exhausted.

Philadelphia, Pa., Aug. 23.—Mrs. Bertha Roder, the wife of a striking textile worker, who had been struggling with poverty because of the strike, without food and without money to pay the rent due the next day, shuts herself and her four children in a room and turns on the gas. When Roder returned from a meeting of the strikers' committee, where he had tried to obtain relief, he finds two of the children dead and the others unconscious.

McKeesport, Pa., Aug. 25.—Benjamin Hodgson, an employee of the Port Une mills, who had continued at work, is brutally kicked and beaten almost at his own door yard by a crowd of strikers. When his wife comes to his rescue she is also struck in the face and knocked down. They are both aged and their injuries are serious.

New York, Aug. 25.—John E. Denny, an employee of the John N. Robins Shipbuilding Company, who had been an open antagonist of Sam Parks, and whose life had often been threatened, is found dead in the Erie Basin near the Long Dock. His wife says he left home in the best of spirits and believes he was murdered.

Chicago, Ill., Aug. 26.—Otto Milz, a non-union plasterer, is waylaid by two members of the union, knocked down and kicked and jumped on until senseless. When discovered an hour later his nose was broken, his scalp cut in a dozen places and his body a mass of bruises.

New Orleans, La., Aug. 28.—Marsh Belcher, a non-union wagon worker, is set upon by three strikers and so terribly beaten by wagon spokes that he is obliged to remain in bed for four days.

McKeesport, Pa., Aug. 29.—A number of the Port Une employees are bombarded with stones while on their way home from work.

Clearfield, Pa., Aug. 30.—Seven striking brick workers are fined for creating a disturbance at the Harbison-Walker Works at Stronach. They are part of a gang that visited the plant nightly, hooting and threatening, and had made a partially successful attempt to wreck the pumping station that supplies the works with water.

In some of the shops of the Prussian State Railroads apparatus for making coffee and also for ærating water were provided last summer, and the results were such that the Minister of Public Works authorized their purchase not only for shops but for all the principal places where trainmen spend the night away from home, and the supplying of the coffee and ærated waters, lemonade, etc., at cost price. The chief object seems to be to avoid an immoderate consumption of beer, etc.

The Proportions of Modern Locomotives.*

In collecting and arranging the data presented in the accompanying tables, two objects were held in view. First, to collect the main dimensions of a number of representative locomotives so as to show the tendencies of modern American practice; and second, to compare the dimensions of the locomotives with one another by a simple and logical method. The investigation covers over 250 locomotives.

Tables 1 to 17 show the dimensions for each locomotive and the ratios which have been calculated for purposes of comparison. [These tables have not been reproduced.—Editor.] The dimensions considered are weight, cylinder diameter and stroke, driving wheel diameter, boiler pressure, total heating surface, and grate area. The maximum cylinder tractive effort has been calculated in each case, the mean effective pressure for the single expansion engines being taken at 85 per cent. of the boiler pressure, for the four-cylinder compounds at two-thirds of the boiler pressure in the high pressure, and one-quarter in the low pressure cylinders; and for the two-cylinder compounds the work has been assumed equally divided between the cylinders, the high pressure working with a mean effective pressure equal to two-thirds of the boiler pressure.

The locomotives are arranged in the tables according to type and class: Type is used to indicate the wheel arrangement, while class is used in reference to the style of cylinders, whether single expansion or compound. The tandem and Vauclain compounds have not been separated, as the difference between these does not affect any fundamental principle of design.

The dimensions enumerated above are given in columns 2 to 9 of the tables, and in columns 10 to 12 are given factors measuring the ratios which the four important dimensions of adhesive weight, tractive effort, heating surface, and grate area bear to each other. Column 13 gives a factor of steam consumption, and column 14 the total weight of the engine per square foot of heating surface. These five factors give a fairly complete analysis of the proportions of the locomotives and afford means for a rational comparison of different designs. The first three factors (columns 10, 11 and 12) are based on the four determining dimensions of the locomotive, weight on drivers, cylinder tractive effort, heating surface, and grate area, measuring respectively the ratios of weight on drivers to tractive effort, of tractive effort to heating surface, and of heating surface to grate area. For convenience of reference each factor is designated by a letter which is so chosen as to correspond to the factor represented, as:

Weight on drivers to tractive effort, factor of Adhesion . . . A.
Tractive effort to htg. surface, factor of Boiler capacity . . . B.
Htg. surface to grate area, factor of Combustion conditions . C.

The steaming capacity factor in column 13 is obtained by multiplying the factor B by the driving wheel diameter D, and is therefore represented by BD. The total weight divided by the heating surface gives a factor of Efficiency of design and is represented by E. The values of these factors have been averaged for each class of locomotive, and these average values have been collected into separate tables which are discussed below.

Table 18 gives a synopsis of Tables 1 to 17, showing the average values of the various dimensions and factors, these average values of the various factors being given for each group as well as for each complete table. By this means the relation between the weight and average value of each factor can be examined. It will be seen that the heavier engines show a higher steaming capacity and are lighter per square foot of heating surface indicating that generally speaking a heavy engine has more heating surface for its cylinder power and weight than a lighter engine.

From the average dimensions given in Table 18, it is seen that the average of 24 single expansion Atlantic type (4-4-2) engines gives a total weight of 165,400 lbs. with 92,000 lbs. on drivers, 22,000 lbs. tractive effort and 2,800 sq. ft. of heating surface, the weight on drivers being 55.6 per cent. of the total weight. The average American type (4-4-0) weighs 133,700 lbs. with 65 per cent. of this, or 87,000 lbs., on drivers, 21,000 lbs. tractive effort and 2,177 sq. ft. of heating surface. The average of 35 single expansion 10-wheelers shows a total weight of 158,000 lbs. with 122,000 lbs. (77.3 per cent. of the total) on drivers, 26,200 lbs. tractive effort and 2,480 sq. ft. of heating surface. For the consolidations, 48 single expansion engines are combined, giving an average weight of 180,500 lbs., of which 159,500 lbs., or 88.4 per cent., is on the drivers. The tractive effort averages 39,900 lbs. and the heating surface 2,760 sq. ft.

The average values of the various factors are collected to compose Tables 19 to 22.

Factor A, or Factor of Adhesion. Table 19.—This factor is obtained by dividing the weight on driving wheels by the maximum cylinder tractive effort. The individual values for each engine are given in column 10 of Tables 1 to 17, and the averages of the individual values having been found for each class of engine are collected in Table 19, where they are so arranged that the factors for the single expansion engines are in ascending order of magnitude. It will be seen that the single expansion consolidation, American and Atlantic type engines show averages in the neighborhood of 4, but an examination of the individual factors in column 10 of Tables 10, 6 and 4 will show a number of fairly wide departures from this

*Extracts from a paper by Lawford H. Fry, presented to the New York Railroad Club, September, 1903.

average. The greatest variation is found among the consolidations, which show a maximum value of 5.04 and a minimum value of 3.32. This is a considerable departure from the factor of 4.25 recommended by the Master Mechanics' Association in 1897. The very low factors may be explained in one of two ways, either the locomotives are worked at a lower boiler pressure than that given in the published figures from which the tables are compiled, or the cylinders are made comparatively large, so that when working with a reasonably short cut-off and thus developing less than the maximum tractive effort, the working tractive effort shall be large enough to utilize a large proportion of the weight on driving wheels. The 10-wheelers show an average factor of 4.69 with a maximum of 5.47 and a minimum of 3.52. The Pacific type engines average 4.28 and the Prairie type 4.96, without any very wide variation. The moguls have an average factor of adhesion of 4.47. The considerable difference between this factor and that found for the consolidations is hard to explain, as there is apparently no reason why the two factors should not be practically the same.

The average values for the two-cylinder compounds differ but slightly from those obtained for the single expansion engines.

The four-cylinder compounds show average factors from 5 to 15 per cent. higher than the single expansion engines. This is because the compounds are designed to work at a longer cut-off, and, on starting, live steam can be admitted to the low-pressure cylinders so as to develop, for a short time 10 per cent. more tractive effort than is given by the formula. The tractive effort for the four-cylinder compounds is calculated from a formula which gives the maximum cylinder tractive effort which can be maintained when working compound.

Factor BD, or Factor of Steam Consumption. Table 21. Factor B. Table 20.—The factor B is obtained by dividing the tractive effort by the heating surface. The individual values are given in column 11 of Tables 1 to 17, and the average values are collected in Table 20. These averages are of some interest as showing for the various classes of locomotives the amount of maximum tractive effort which is developed per square foot of heating surface.

The following simple calculations show the exact relation existing between the factor BD and the rate of steam consumption:

Let V be the speed in miles per hour.
T the maximum cylinder tractive effort.
p the percentage of maximum tractive effort developed at the speed V.

then pT is the tractive power at the speed V.

Let h be the amount of water required per h.p. per hour by the cylinders.
Q be the total amount of water used per hour.
S the heating surface in sq. ft.
q the amount of water evaporated per sq. ft. of heating surface per hour.

then $$q = \frac{Q}{S}$$

Let r be the number of revolutions made by the driving wheels per minute at the speed V.
D the driving wheel diameter in inches.

then $$V = \frac{r\,D}{336}$$

Now the horse-power developed is $$\frac{p\,T\,V}{375}$$

Hence the water consumed is $$Q = \frac{p\,T\,V\,h}{375}$$

therefore $$\frac{Q}{S} = \frac{p\,h}{375}\,V\,\frac{T}{S}$$

But $\frac{Q}{S} = q$ and $\frac{T}{S}$ is the factor B, hence

$$q = \frac{p\,h}{375}\,V\,B \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (1)$$

This establishes the relation between the factor B, the necessary rate of evaporation, the cylinder conditions and the speed in miles per hour.

By transposing equation (1) we have

$$V = \frac{375}{p\,B} \cdot \frac{q}{h} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (2)$$

from which it can be shown that B measures the maximum speed at which the boiler can supply steam enough to maintain the maximum tractive effort Let v represent this speed, then $p = 1$ and for the generality of cases $\frac{q}{h}$ may be put equal to $\frac{1}{3}$, that is to say, 3 sq. ft. of heating surface are required for each horse-power developed. Equation (2) then becomes

$$v = \frac{125}{B} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (3)$$

Or in other words the highest speed at which the maximum tractive effort can be maintained is found by dividing 125 by B.

To replace the speed in miles per hour by its equivalent number of revolutions per minute, equation (1) is modified by substituting for V its equivalent $\frac{r\,D}{386}$. The equation then becomes

$$q = \frac{p\,h}{126{,}000}\,r\,BD \ldots\ldots\ldots\ldots\ldots\ldots\ldots (4)$$

which connects the factor BD with the rate of evaporation, the cylinder conditions, and the number of revolutions per minute. From this equation it will be seen that with given cylinder conditions and speed (p, h and r constant) the rate of evaporation (q) must be directly proportional to the value of the factor BD. That is, with a high value of BD the cylinders will make large demands on the evaporative power of the boiler, while with a low value of BD the boiler need not be forced to the same extent.

Further, under similar cylinder conditions the speed is limited by the ability of the boiler to produce steam, and consequently with the same rate of evaporation per square foot of heating surface, the locomotive with the lowest rate of steam consumption, that is, the lowest value for the factor BD, will be capable of the highest speed, while a high value of the steam consumption factor will only permit a low speed. The conclusion thus arrived at by theoretical means is borne out by the figures obtained from practice. The values for the steam consumption factor BD as shown in Table 21 are low for the high speed engines such as the Atlantic, Pacific and Prairie types, and high for the low speed consolidations, mastodons and moguls, with the 10-wheelers taking intermediate values as medium speed engines.

There is unfortunately no standard method for comparing the steaming capacity of locomotives, and the steam consumption factor BD is suggested for this purpose. It is easily found for any engine, the calculation being simple in the extreme (the maximum tractive effort is multiplied by the driving wheel diameter and divided by the heating surface); it takes into account all the dimensions directly affecting the steam consumption and production, as cylinder diameter and stroke, boiler pressure and heating surface; and as shown above, it measures accurately the rate at which each square foot of heating surface must produce steam to maintain given cylinder and speed conditions. The objection which may be made to the use of a factor of this sort is that it does not take any account of the relative value of heating surface. A well-designed boiler may, under similar conditions, be capable of evaporating considerably more water per square foot of heating surface than can a poorly designed boiler, and it may be urged that this should be taken into account in establishing a steaming capacity factor. This is true enough, but in the present state of knowledge it is not possible to set up a formula, based on boiler dimensions, which shall give in exact terms the evaporative power of a locomotive boiler. At present the only safe method of comparison is to use a factor, such as the steam consumption factor BD, to measure the rate of evaporation per square foot of heating surface, and then to only attempt accurate comparisons between locomotives having generally similar boilers, so that it may be assumed that the maximum rates of evaporation are reasonably near each other. Then whenever accurate information is at hand regarding the evaporative power of a boiler, the actual maximum rate of evaporation per square foot of heating surface can be compared with the rate of steam consumption per square foat, as found from BD, the difference indicating the reserve power of the locomotive.

Factor C, or Factor of Combustion Conditions.—This factor is obtained by dividing the total heating surface by the grate area. As is well known, it indicates the quality of coal for which the boiler is adapted. Usual values are about 55 to 65 for good bituminous coal and 25 to 35 for anthracite. No averages have been taken for the values of this factor. To obtain satisfactory results by averaging, it would be necessary to classify the engines according to the quality of fuel used and sufficient information on this subject is not available.

The minimum value found in the tables is 23.7, on the Southern Pacific 150,000 lbs. single expansion 10-wheeler (4-6-0), while the maximum value is 103.5, shown by the Pittsburg, Bessemer & Lake Erie 250,000-lb. single expansion consolidation. Values of 75 to 80 are by no means uncommon. In examining the values of this factor it must be borne in mind that a large value of the factor does not necessarily mean that the grate area is too small. It may be that the factor is large because the heating surface is large, and in this case the large factor does not indicate a defective boiler design. On the contrary, the boiler should prove economical, for while there is sufficient grate area to give a proper rate of combustion, there is ample heating surface to absorb the heat developed on the grate. If, on the other hand, the factor C is high because the grate area is deficient, a high rate of combustion must be maintained. In order to determine whether a high value of C is due to an excess of heating surface or a deficiency in grate area, the factor should be examined in connection with the steam consumption factor BD. If BD is below the average, it indicates only moderate demands on the boiler; that is to say, ample heating surface for the work, and the factor C can be as much above the normal as the factor BD is below. Conversely in judging of the steaming capacity of a locomotive by the steam consumption factor BD, attention should be given to the combustion factor C.

A low steam consumption factor BD indicates that the heating surface is lightly taxed by the cylinders; but it may be that a high value of the factor C will show that the grate area is so small in proportion to the heating surface as to limit the capacity and prevent the engine from steaming as freely as would be expected from the low steam consumption factor.

The relation between the factor C and the conditions of combustion as measured by the rate of combustion and the quality of the coal is determined as follows:

Let q be the amount of water evaporated per sq. ft. of heating surface per hour.
Q the total amount of water evaporated by the boiler per hour.
S the total heating surface in sq. ft.

then $qS = Q$.

Let k be the amount of coal consumed per sq. ft. of grate per hour.
G the grate area in sq. ft.
K the total amount of coal burned per hour.

then $kG = K$.

Let e be the number of pounds of water evaporated per pound of coal.

then $$e = \frac{Q}{K}$$
$$= \frac{q\,S}{k\,G}$$

but $\frac{S}{G}$ is the factor C,

hence $$e = \frac{q}{k}\,C$$

or $$C = \frac{k\,e}{q} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (4)$$

That is to say, given the proper rate of combustion of the coal, its evaporative power, and the rate of evaporation to be attained, the factor C or ratio of heating surface to grate area is found by multiplying the rate of combustion by the evaporative value and dividing by the rate of evaporation.

Factor E, or Factor of Efficiency of Design.—The factor shows the total weight of the locomotive for each square foot of heating surface. In each class the group averages do not vary greatly, though there is a generally noticeable tendency for the heating surface of the larger engines to be secured with less weight than that of the smaller engines. It will be noticed in Table 22 that the high-speed engines are the lightest per square foot of heating surface, the weight gradually increasing as the capacity for speed is done away with. In spite of the regularity of the average values of the factor E, an examination of the individual values shows some very considerable variations, the weights running from 49.4 lbs. to 83.5 lbs. per sq. ft. of heating surface. These are exceptional cases and the average values of Table 22 appear to show with reasonable accuracy what weight may be counted on for a given heating surface for any class of engine.

It is now seen how the four factors A, BD, C and E constitute a complete general analysis of any locomotive design. A shows the relation between the tractive power developed and that which can be utilized. BD shows the relation between cylinders and heating surface, that is, between steam consumption and steam production. C shows the relation between heating surface and grate area, that is, between the space available for the production of heat from the coal and the space available for the absorption of this heat. E shows the efficiency with which the designer has disposed of his material in obtaining heating surface.

TABLE 18.—AVERAGE VALUES OF DIMENSIONS AND FACTORS.

1	2	Classification. 3	4	5	Average Values. 6	Dimensions. 7	8	9	10	11	Factors. 12	13	14
					W.	w.	D.	T.	S.	A.	B.	BD.	E.
Table.	Type.	Class.	No. of locos.	Limits of total wgt. in group.	Total wgt.	Weight on drivers.	Diam. of drivers.	Cyl. tractive effort.	Heating surface.	Wgt. on drvrs. / Tract. effort.	Tract. effort. / Htg. surface.	Trac. eff. x Drv. Dia. / Heating surface.	Total weight. / Htg. surface.
1	4-6-2	S.E.	5	219,000—173,000	199,600	133,300	71.8	31,200	3,621	4.28	8.66	621	55.1
2	2-6-2	S.E.	6	203,600—140,000	175,400	126,500	70.1	25,600	3,072	4.96	8.51	592	57.6
3	2-6-2	4 c com.	4	209,900—176,200	196,600	137,700	68.7	30,200	3,403	4.61	8.94	609	58.0
4	4-4-2	S.E.	24	190,000—130,000	165,400	92,000	78.4	22,600	2,800	4.11	8.15	637	60.0
5	4-4-2	4 c com.	16	200,000—130,000	167,000	87,300	81.2	18,400	2,659	4.76	7.01	568	63.7
6	4-4-0	S.E.	16	147,000—104,000	133,700	87,000	71.7	21,600	2,177	4.03	9.94	711	61.7
7	4-6-0	S.E.	35	180,000—130,000	158,000	122,000	69.0	26,200	2,480	4.69	10.75	735	65.0
8	4-6-0	4 c com.	17	192,000—130,000	176,000	130,000	68.5	26,300	2,720	4.96	9.76	665	64.8
9	4-6-0	2 c com.	10	180,000—120,000	156,400	116,700	64.8	25,000	2,370	4.68	10.67	689	66.7
10	2-8-0	S.E.	48	250,000—120,000	180,500	159,500	55.6	39,900	2,760	4.03	14.61	810	65.3
11	2-8-0	4 c com.	27	225,000—155,000	191,800	169,200	56.5	39,900	2,900	4.27	14.02	790	67.5
12	2-8-0	2 c com.	13	200,000—144,000	180,000	158,000	57.5	39,300	2,820	4.05	14.11	811	65.3
13	2-6-0	S.E.	15	170,000—125,000	152,000	131,000	61.0	29,400	2,270	4.47	13.02	797	67.8
14	2-6-0	4 c com.	3	170,000—164,000	166,400	142,400	60.7	30,300	2,336	4.71	13.09	791	71.8
15	2-6-0	2 c com.	2	165,000—154,000	159,700	134,200	59.0	31,350	2,433	4.29	12.87	759	65.7
16	4-8-0	S.E.	6	222,000—170,000	202,200	164,900	55.1	42,900	2,981	3.88	14.30	789	68.0
17	4-8-0	2 c com.	7	213,000—180,000	191,600	153,300	54.9	37,700	2,805	4.08	13.71	752	69.8

Table 19.—Factor "A" or Factor of Adhesion.

Type.	Single expansion. Number of locos.	Single expansion. Factor of adhesion.	4-cylinder compound. Number of locos.	4-cylinder compound. Factor of adhesion.	2-cylinder compound. Number of locos.	2-cylinder compound. Factor of adhesion.
Mastodon, 4-8-0	6	3.88	..	...	7	4.08
Consolidation, 2-8-0	48	4.03	27	4.27	13	4.05
American, 4-4-0	16	4.06	..	...	..	...
Atlantic, 4-4-2	24	4.11	16	4.76	..	...
Pacific, 4-6-2	5	4.28	..	...	..	...
Mogul, 2-6-0	15	4.47	3	4.71	2	4.29
Ten-Wheel, 4-6-0	35	4.69	17	4.96	10	4.68
Prairie, 2-6-2	6	4.96	4	4.61	..	...

Table 20.—Factor "B."

Type.	Single expansion. Number of locos.	Single expansion. Factor.	4-cylinder compound. Number of locos.	4-cylinder compound. Factor.	2-cylinder compound. Number of locos.	2-cylinder compound. Factor.
Atlantic, 4-4-2	24	8.15	16	7.01	..	...
Prairie, 2-6-2	6	8.51	4	8.94	..	...
Pacific, 4-6-2	5	8.66	..	...	..	...
American, 4-4-0	16	9.95	..	...	..	...
Ten-Wheel, 4-6-0	35	10.75	17	9.76	10	10.67
Mogul, 2-6-0	15	13.02	3	13.09	2	12.87
Mastodon, 4-8-0	6	14.30	..	...	7	13.71
Consolidation, 2-8-0	48	14.61	27	14.02	13	14.11

Table 21.—Factor "BD" or Factor of Steam Consumption.

Type.	Single expansion. Number of locos.	Single expansion. Factor.	4-cylinder compound. Number of locos.	4-cylinder compound. Factor.	2-cylinder compound. Number of locos.	2-cylinder compound. Factor.
Prairie, 2-6-2	6	592	4	609	..	...
Pacific, 4-6-2	5	621	..	...	..	...
Atlantic, 4-4-2	24	637	16	568	..	...
American, 4-4-0	16	711	..	...	..	...
Ten-Wheel, 4-6-0	35	735	17	665	10	689
Mastodon, 4-8-0	6	789	..	...	7	752
Mogul, 2-6-0	15	797	3	791	2	759
Consolidation, 2-8-0	48	810	27	790	13	811

Table 22.—Factor "E" or Factor of Efficiency of Design.—Weight in Pounds Per Square Foot of Heating Surface.

Type.	Single expansion. Number of locos.	Single expansion. Factor.	4-cyl. comp. Number of locos.	4-cyl. comp. Factor.	2-cyl. comp. Number of locos.	2-cyl. comp. Factor.	All classes. Number of locos.	All classes. Factor.
Pacific, 4-6-2	5	55.1	..	...	..	...	5	55.1
Prairie, 2-6-2	6	57.6	4	58.0	..	...	10	57.9
Atlantic, 4-4-2	24	60.0	16	63.7	..	...	40	61.4
American, 4-4-0	16	61.7	..	...	..	...	16	61.7
Ten-Wheel, 4-6-0	35	65.0	17	64.8	10	66.7	62	65.3
Consolidation, 2-8-0	48	65.3	27	67.5	13	65.3	89	65.9
Mogul, 2-6-0	15	67.8	3	71.8	2	65.7	20	68.2
Mastodon, 4-8-0	6	68.0	..	...	7	69.8	13	69.0

Train Accidents in the United States in August.[1]

bc, 1st, 11 p.m., Cincinnati, New Orleans & Texas Pacific, Greenwood, Ky., butting collision of freight trains, each of which had two engines, wrecking four engines and many cars. Four firemen were killed and three enginemen injured. A man stealing a ride is said to have been killed also. There had been an error in the copying of the despatcher's order appointing the meeting station for the two trains, the order as delivered to one of the trains reading "third section" while the same order delivered to the other train read "fourth section." It appears that the operator who made the mistake in receiving the order made the same mistake in repeating it to the despatcher, but that the latter did not notice the error. The safety of the trains was not, however, wholly dependent on the correctness of these orders, as the road is equipped with automatic block signals; but the enginemen of the northbound train appear to have deliberately passed a signal which was set against them.

dn, 1st, Delaware & Hudson, Coopersville, N. Y., a freight train ran upon the drawbridge over Big Chazy River while it was unfastened, and the engine and 11 cars fell 20 ft. to the river below. The fireman was killed and the engineman injured.

unf, 1st, Wabash road, Council Bluffs, Iowa, a freight train was derailed by running over a cow, and the engine fell down a bank. Seven cars were wrecked. Three trainmen were killed.

unf, 2nd, Yazoo & Mississippi Valley, Memphis, Tenn., a freight train was derailed by running over a mule and the engine was ditched. The engineman was killed and a tramp was injured.

bc, 3rd, 3 a.m., Pittsburgh, Cincinnati, Chicago & St. Louis, Hartford City, Ind., butting collision between an eastbound passenger train and a westbound freight, wrecking both engines, many freight cars, two baggage cars and one passenger car, the smoker. The freight train had been delayed by an accident and was at a standstill. A flag was sent forward, but in consequence of a fog it appears not to have been seen in season. Twenty passengers and one trainman were injured.

dn, 3rd, 4 a.m., Baltimore & Ohio, Martinsburg, W. Va., a locomotive was derailed at a misplaced switch and overturned. The engineman was killed and the fireman badly scalded.

rc, 4th, Great Northern, Havre, Mont., a passenger train which had been stopped to wait for a herd of cattle to clear the track, was run into at the rear by a following passenger train, and the engine of the second and the parlor car of the first train were badly damaged. Four persons were injured.

o, 4th, Northern Central, Timonium, Md., the locomotive of a freight train was wrecked by the explosion of its boiler, and the engineman and fireman were killed.

5th, Pittsburg, Cincinnati, Chicago & St. Louis, Scio, Ohio, an eastbound passenger train, running at high speed, was derailed on a curve and the engine was ditched and wrecked. The engineman and fireman were fatally scalded. The derailment appears to have been due to an obstruction on the track or to some part of engine dropping down on track.

unx, 5th, Missouri, Kansas & Texas, Summit, Ind. T., a freight train was derailed and 10 cars were wrecked. Two unknown men riding on one of the cars were killed and a brakeman was injured.

†rc, 7th, 3.45 a.m., Durand, Mich., a circus train which had been stopped at the entrance to the yard was run into at the rear by a following train carrying a part of the same circus, and a caboose and one sleeping car were wrecked. Several other cars were badly damaged. Twenty-one employees of the circus and two employees of the railroad company were killed, and over 30 circus men were injured. A statement given out by an officer of the road after the collision said that the flagman of the foremost train gave proper lantern and torpedo signals about 4,000 ft. back from the standing train; that the engineman of the second train answered the signals given by the flagman, but found that his train was not charged with air and therefore was unable to reduce his speed. The Trainmaster of the division, James McCarthy, riding in the caboose of the foremost train, was one of the persons killed. After the collision, the five sleeping cars at the rear of the second train were found detached from the forward part of the train, with a damaged drawbar, indicating that the train had broken apart, that the parts had collided and rebounded, and that therefore there was no automatic application of the air-brakes. After the collision, the air-brakes of this train were found to be in good condition. (See editorial column.)

bc, 9th, Cleveland, Cincinnati, Chicago & St. Louis, Anderson, Ind., butting collision between passenger train No. 21 and freight train No. 62, damaging both engines and several cars. Four trainmen were injured.

bc, 9th, Missouri, Kansas & Texas, Dallas, Texas, butting collision between southbound train No. 5 and northbound passenger train No. 34, wrecking both engines. One pasenger, both enginemen and one other trainman were injured, one of the enginemen fatally.

10th, Missouri, Kansas & Texas, Schell City, Mo., passenger train No. 6 was derailed and about 20 passengers and trainmen were injured.

unf, 10th, 11 p.m., Southern Railway, Gastonia, N. C., passenger train No. 35 was derailed at a misplaced switch and the engine and mail car were badly damaged. Four trainmen were injured. It is said that the switch had been maliciously misplaced.

dn, 13th, Southern Railway, Melrose, N. C., freight train No. 62, third section, became uncontrollable on the steep Saluda grade and the engine and 13 cars of coal were derailed and wrecked. The engineman and fireman were killed and a brakeman was badly injured.

unf, 13th, 3 a.m., Chicago, Rock Island & Pacific, McFarland, Kan., passenger train No. 3 was derailed at a bridge weakened by a flood and the locomotive and first two cars were submerged. The fireman was drowned. The baggageman, express messenger and engineman saved their lives by jumping into the flood in Hendricks Creek, though they had to cling to treetops for several hours before they were rescued. At the time of the derailment, the train was running slowly across the bridge.

xc, 14th, Pennsylvania Lines, Van Wert, Ohio, a passenger train ran over a misplaced switch and collided with a platform car standing on a side-track, wrecking the engine, mail car and several other cars. The engineman was killed and 13 other trainmen and postal clerks were injured.

unf, 14th, Denver & Rio Grande, Nathrop, Colo., a passenger train broke through a bridge which had been weakened by a flood and the baggage car was wrecked; 14 passengers were injured.

*rc, 15th, 2 a.m., Pennsylvania road, Radnor, Pa., an eastbound freight train ran into the rear of a preceding freight, wrecking 12 cars. Two brakemen were killed and a tramp was injured. There was a dense fog at the time. The wreck took fire and was partly burnt up.

xc, 15th, Central of New Jersey, Ashley, Pa., a freight train became uncontrollable on a steep descending grade, where it had been left standing while its engine was run forward for water, and collided violently with the engine. Eighteen cars were wrecked and a brakeman was fatally injured. A man standing near the track was injured also.

15th, Texas & Pacific, Sherman, Texas, eastbound freight train No. 38 broke through a bridge and 10 loaded cars were wrecked.

bc, 16th, Southern Railway, Cleveland, Tenn., butting collision between a freight train and an excursion passenger train, badly damaging both engines and several cars. One passenger was injured.

xc, 16th, Erie road, Cleveland, Ohio, a passenger train ran over a misplaced switch and collided with a switching engine, wrecking the baggage car. Two passengers and four trainmen were injured.

bc, 17th, Chicago, Milwaukee & St. Paul, Long Lake, Ill., butting collision of passenger trains, making a bad wreck. One employee was killed and four were injured. The collision was due to a mistake in copying a telegraphic order.

o, 17th, Chicago, Cincinnati & Louisville, Wynn, Ind., the locomotive of a freight train was damaged by the breaking of a side rod; the conductor and fireman were killed and two other trainmen were injured.

dr, 19th, Rockaway Valley road, Peapack, N. J., a mixed train was derailed by spreading of rails and one passenger car and one freight car fell down a bank. One passenger and two employees were injured.

19th, St. Louis & San Francisco, Everton, Mo., a freight train was derailed, apparently in consequence of insecure track, and 13 cars of freight were ditched. A tramp, stealing a ride, was killed and two others were fatally injured.

xc, 20th, 4 a.m., Pennsylvania road, Bradenville, Pa., 30 cars broke away from a freight train ascending a steep grade and ran back several miles into the head of a following freight, wrecking the two engines and 25 cars. Two trainmen were injured. The wreck took fire and was mostly burnt up.

xc, 20th, Baltimore & Ohio, Connellsville, Pa., a passenger train ran over a misplaced switch and into the side of a moving freight train. The engine and three freight cars were wrecked. Five passengers and four trainmen were injured.

eq, 20th, Pennsylvania road, Fowler, Pa., a freight train running at good speed was derailed by the breaking of a wheel, and 15 cars were wrecked. A man stealing a ride was killed and a brakeman was injured.

rc, 22d, Fonda, Johnstown & Gloversville, Mayfield, N. Y., a train of empty passenger cars ran into the rear of a preceding passenger train, badly damaging one passenger car. Several passengers were injured.

bc, 22d, Baltimore & Ohio, Bloom, W. Va., butting collision between a passenger train and a freight. The passenger engine and the baggage car were badly damaged. A man stealing a ride was killed.

†eq, 22d, Northern Pacific, Chehalis, Wash., an excursion passenger train was derailed and the engine and first three cars fell down a bank. One passenger and one tramp were killed and 30 passengers and three trainmen were injured. The derailment was caused by the explosion of the boiler, the crown sheet, owing to low water, having been forced down into the fire-box. Parts of the fire-box got under the wheels, or else the engine was derailed by the shock of the explosion.

23d, 3 a.m., New York Central & Hudson River, Little Falls, N. Y., a newspaper train running at very high speed was derailed on a curve. The tender and the first one of the three cars were ditched and the other two cars were thrown crosswise of the tracks. The engineman and fireman were killed and two newspaper messengers were injured.

bc, 24th, Chesapeake & Ohio, Glenn, Ky., butting collision of freight trains, badly damaging all of the four engines drawing the trains. One fireman was injured.

xc, 24th, Bloomington, Ill., a passenger train of the Lake Erie & Western was run into by a freight car of the Illinois Central at the crossing of the two roads, and one passenger car was partly overturned. Forty-four passengers were injured, most of them very slightly. There are no fixed signals or derailing switches at the crossing. The freight car, which had eluded control, was part of a train consisting of an engine, and this one car, with the engine in the rear, which had started from the Illinois Central station, about two miles away, a few minutes before. On approaching a switch near the crossing, where the car was to be set off, the application of brakes on the engine disclosed the fact that the car had become uncoupled. The air-brakes not being connected, the car, having been pushed at considerable speed, thus ran uncontrolled some little distance before the hand brakes could be applied. Although there were three men on the car, and they tried to apply the brakes, they were unable to stop the car before it reached the crossing. The examination after the accident disclosed no defect in the hand brake of the car or in the couplers which came apart.

†24th, 2 a.m., Chicago & North Western, Fond du Lac, Wis., passenger train No. 15 was derailed and eight cars fell down a bank. One passenger was killed and 20 passengers and two trainmen were injured.

o, 24th, Northern Central, Timonium, Pa., a car in a passenger train was set afire by the explosion of a gas lamp and 12 passengers were burned or otherwise injured.

rc, 25th, Baltimore & Ohio, West Union, W. Va., a freight train ran into the rear of a preceding freight, which was standing at the station, and three trainmen were injured.

rc, 25th, Baltimore & Ohio, New Philadelphia, Ohio, a passenger train ran into the rear of a preceding freight, injuring four employees and one passenger.

o, 25th, Lake Shore & Michigan Southern, Girard, Pa., the locomotive of a freight train was badly damaged by the rupture of its crown sheet. The explosion caused the death of the engineman and the fireman, and a brakeman was badly scalded. The men were thrown out of the cab. The train continued its course, and the first that was known of the accident by the conductor and rear brakeman was when they saw from the caboose windows the bodies of the victims lying at the side of the track.

rc, 26th, Missouri, Kansas & Texas, Rhinelands, Mo., passenger train No. 3 ran into the rear of a preceding freight, wrecking the caboose and damaging the engine. The fireman was killed and the engineman and a tramp were injured.

dn, 27th, Baltimore & Ohio, Wildwood, Pa., a freight train which had become uncontrollable on a descending grade was derailed at a curve and several cars were wrecked. One of the cars fell against a sleeping car in a circus train, which was passing on an adjacent track.

27th, Chicago, Burlington & Quincy, Kent, Iowa, a freight train broke through a bridge which had been weakened by a flood, and the engine and 17 cars were wrecked. The engineman and fireman escaped by swimming to the shore.

unf, 27th, Denver & Rio Grande, Glenwood Springs, Colo., a freight train was derailed by a rock which had fallen upon the track, and the engine was overturned. The engineman was fatally scalded.

unx, 27th, Northern Pacific, Dickinson, N. Dak., a freight train was derailed and wrecked and one man was killed.

27th, International & Great Northern, Marlin, Texas, a passenger train was derailed and the engine was wrecked. The engineman was killed and the fireman injured.

28th, Wisconsin Central, Silver Lake, Wis., collision between a passenger train and a freight; four trainmen injured.

dn, 28th, Philadelphia & Reading, Philadelphia, Pa., a locomotive which was by the mistake of a signalman turned on to a wrong track was derailed at a turntable pit and overturned. The fireman was killed.

o, 28th, 10 p.m., Oregon Railroad & Navigation Company's Line, Weatherby, Ore., the locomotive of a freight train was wrecked by the explosion of its boiler. The fireman was killed and the engineman fatally injured.

rc, 29th, Erie road, Turners, N. Y., a westbound milk train ran into the rear of a preceding milk train at high speed, wrecking the two passenger cars at the rear of the foremost train. Of the 35 persons in these cars, one was killed and 17 were injured. It is said that the second train had been admitted into the same block section with the first by reason of a false report sent from the outgoing end of the section. The signalman at this end claimed that he left his office for a short time, and when he came back assumed that the foremost train had passed his station, when in fact it had not arrived.

xc, 29th, Norfolk & Western, Chilhowie, Va., collision between a switching engine and a work train; one trainman killed and one injured.

xc, 29th, Pennsylvania Lines, Flat Rock, Ind., collision between a freight train and a work train, making a bad wreck. Two employees were fatally burned.

xc, 30th, Norfolk & Western, Elkton, Va., a freight train ran into the rear of a preceding freight and the engine and three cars were wrecked. Four trainmen were injured.

xc, 31st, Pennsylvania Lines, Mingo Junction, Ohio, a passenger train was by mistake run into a side track and collided with four cars standing there. The engineman and fireman were injured.

dn, 31st, Denver & Rio Grande, Colorado City, Colo., a freight train became uncontrollable on a steep grade and after running some distance was derailed, and 16 cars and two engines were wrecked. The engineman and fireman jumped off while the train was moving at furious speed, but it does not appear that they were badly injured.

unx, 31st, Virginia & South Western, Bristol, Tenn., a freight train was derailed and the caboose was overturned. The conductor was killed.

o, 31st, Illinois Central, Chicago, Ill., a car in a passenger train was badly damaged by the door of a car in a freight train passing on an adjacent track. Two passengers and two trainmen were injured.

[1] Accidents in which injuries are few or slight and the money loss is apparently small, will as a rule be omitted from this list. The official accident record published by the Interstate Commerce Commission quarterly is regularly reprinted in the *Railroad Gazette*. The classification of the accidents in the present list is indicated by the use of the following

ABBREVIATIONS.

rc	Rear collisions.
bc	Butting collisions.
xc	Miscellaneous collisions.
dr	Derailments; defect of roadway.
eq	Derailments; defect of equipment.
dn	Derailments; negligence in operating.
unf	Derailments; unforeseen obstruction.
unx	Derailments; unexplained.
o	Miscellaneous accidents.

An asterisk at the beginning of a paragraph indicates a wreck wholly or partly destroyed by fire; a dagger indicates an accident causing the death of one or more passengers

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EDITORIAL ANNOUNCEMENTS.

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There was an accident on a railroad in Spain last June, in consequence of which 110 people were killed and 140 wounded. This was made the text for some intemperate remarks by a Spanish newspaper, which charges the accident to the unchecked rapacity of the railroad, and its virtual subsidizing of the government officials and the lawmakers who ought to see that the railroads do their duty to the public. With the exception of a few engineers, this paper says all the officers and employees of the Spanish railroads are favorites of the professional politicians, who when out of office are themselves members of the railroad boards of directors, or hold well-paid, sinecure positions under them, as attorneys or otherwise. When one of these becomes a cabinet minister, he nominally resigns his railroad office; but if he goes out of the cabinet (in which changes are frequent) he resumes it and gets pay from the date of his resignation. Under these circumstances no official investigation of railroad abuses ever discovers anything wrong; and the victims of such abuses get substantially no redress. How far these charges are true, we cannot say. It is generally believed, however, that the system of political "pull" has been perfected in Spain to a point reached elsewhere only in some large American cities; and on the other hand Spain has some violent agitators, whose organs may not always adhere to the truth strictly.

Only one case of killing is mentioned in the not at all complete, but nevertheless typical, list of trade union outrages in August. One significant feature is that in several instances where union strikers attempt violence, they are met with violence by the non-union men who are asserting their right to compete in the labor market. Their resistance is sporadic, because they are not organized and have not studied assassination as a fine art. Being on the defensive, they are somewhat at a disadvantage in competing with the man who creeps up behind; nevertheless the month's record shows that some of them do fairly well with revolvers in meeting this emergency. This is said by trade union leaders to be "unfair," and they want the carrying-a-revolver-without-a-permit law enforced. This adaptation of the principle of the interlocking selector to the choosing of laws to be enforced is not new, for early farmers applied it with nice discrimination as to whose ox was gored. It is plain that union strikers do not like to have non-union men fight back, for there seems to be an element of humor in the situation where a big crowd manhandles one person, and this element disappears when there is a real fight. A warm-blooded enthusiasm is aroused in a crowd which jeers, stones, slugs, clubs, knifes, knocks down, kicks and jumps on a ridiculous appearing fellow, but when this current of enthusiasm is reversed and fear overcomes the sportsmen, it is time to look up a policeman.

The plans for the great terminal station which the Pennsylvania is to build at Washington are not yet completed, but one important detail has been decided upon. Instead of the impressive but expensive and sometimes uncomfortable train shed, which has come to be considered a necessity for a large terminal station, the platforms will be covered with umbrella sheds. In the *Railroad Gazette*, August 25, 1899, and again in the issue of April 10, last, the advantages of the umbrella shed for terminal stations were dwelt upon at some length, and in advocating their use, even at the most important stations, we have been, somewhat, a pioneer. The abandonment of the great train shed in this latest of large stations shows that we have not been far wrong. So far as we know, this is the first instance of the use of the umbrella shed at a great terminal, built substantially and designed primarily for comfort. It is probably true that the design is the outgrowth of temporary structures of this pattern built to serve the purpose until there was time or money for following the old fashion which is now being discarded. In such a climate as has Washington, the umbrella shed will afford ample protection from the elements and will be vastly cooler and more comfortable. The cost of such a construction will be only a small part of the cost of a steel-arch train shed over the large number of tracks which will be necessary. The novelty in these sheds as planned, will be that the roofs are, in appearance, inverted, extending well out over the roofs of the cars and shedding water from the eaves toward the center, where it is carried down inside of the supporting columns. The row of columns will form a dividing line for the stream of passengers alighting from and boarding trains. Having the roofs extend well over the cars and draining to the center, prevents the rain or roof drip from falling on the platforms and at the same time gives the passengers waiting in the car all the advantages and comfort of light and air due to being out of doors.

There is a present serious question for consideration by most railroad and nearly all industrial corporations, due to the gradual but enormous reduction in the quoted values of their securities accomplished during the past eight months. It has been a liquidation without panic, a healthy way of correcting the evil condition of inflation, but it is bound to have, nevertheless, some of the harmful results of a panic. It stops for the present the supply of fresh capital to corporations, and it is already quite clear that the recovery of confidence will be slow. How slow it will be, how long it will be before investors will take new issues of railroad and industrial securities, is a question no one can determine, except within wide limits. A year or so would possibly be safe, but that is a long time. It is useless to point out that railroad earnings are satisfactory, that the business of the country is good, the crops are not bad, and that manufacturers are making good money. The last three years have been a period of increase in volume of trade, and in prices obtained. Whenever this increase stops, even if there is no reduction, a vast number of industries are immediately affected. The demand for materials and tools for the enlargement of facilities is then at an end, except in the comparatively few instances where the present facilities are insufficient for the present business. While general business is growing, while factories and railroads have more business offered than they can care for, additions to factories are built, and tools, machinery, cars and locomotives are ordered to keep pace with the increase, but all the trade due to this growth ends when the growth ends. The stock market is commonly called a barometer of trade, simply because its quotations are, in the large, the sum of the guesses of investors all over the world as to business prospects; and the prudent business man takes readings from it, not as the speculator, day by day, but for periods long enough to mean something to him. If it means that we have reached the summit of a three years' increasing wave, it seems plain that there will be a quick cessation of all orders for enlargements, and these are so important in volume as to accelerate a decline in prices for raw materials, for products, and, as a result, in the price of labor.

Flue Spacing in Locomotive Boilers.

The tendency to overcrowd the barrels of locomotive boilers with tubes was criticized in the Report on Recent Improvements in Boiler Design submitted to the last convention of the Master Mechanics' Association. Good reasons were said to exist for questioning the number of tubes used in present standard practice, and the reasons against are summarized as follows: A better circulation due to wider spacing of centers; a reduction of liability to leakage; and longer life to the tube-sheet due to greater section of material between holes.

The need of free, unrestricted circulation in order to secure the highest efficiency of a boiler is emphasized by the statement, in a recent report on marine boilers by the Chief of the Bureau of Steam Engineering, that perfect circulation is the key to the boiler problem.

Since boiler efficiency is a function of amount of heating surface, that boiler will be the most efficient which has the most heating surface, provided such surface is secured under the best conditions. The efficiency of a heating surface is measured by its capacity for absorbing the heat contained in the gases and transmitting it to the water. This capacity depends largely on two conditions; the amount of water, and the frequency of its contact with the heated surface. Heat is transmitted to a body of water but slowly by conduction. Rapid transmission is imparted mostly by convection. This means that the particles of water must be brought in contact successively with the heated surface, or in effect, there must be circulation. The more rapid the rate of combustion in the furnace, the more quickly the steam is generated. This steam must be able to get away freely and there must be water ready to take its place in order that a rapid succession of contacts of the particles of water with the heated surfaces may be maintained. The fierce combustion of a locomotive fire-box demands the freest, most unrestricted circulation of the water if any approach to a satisfactory utilization of the heat units in the fuel is obtained.

The proper relations between grate area, heating surface and cylinder volume have been established by the Master Mechanics' Association; and wider spacing of tubes means a reduction of heating surface, upsetting these relations. But the fact must not be overlooked that these relations are derived from experimental data obtained from locomotives, whose boilers were overcrowded with tubes.

The committee on improvements in boiler design says that there are apparently no serious difficulties in the way of making tests that will demonstrate to what extent evaporation and cost of maintenance is affected by wider spacing. Some facts are already on record. In the last issue of the *Railroad Gazette* the method of wide flue spacing now used by Mr. Tonge on the Minneapolis & St. Louis was shown. The reduction in the number of flues for a 70-ton 2-6-0 locomotive was 62 out of 378, or 16 per cent. Mr. Tonge reports the result to be highly satisfactory in producing good-steaming engines and also that there has been a noticeable reduction in roundhouse repairs because of less boiler work. The reduced cost of a set of flues is an incidental advantage.

The quality of the feed-water is, of course, an important factor in the matter of flue spacing and circulation. Any difficulty due to design is aggravated by accumulated scale and sediment. Setting flues staggered to permit the use of a larger number is a good arrangement to intercept sediment. Straight vertical passages between the rows would largely avoid this.

Can the Proposed Barge Canal Benefit New York?

The grain differential, as viewed by the commissions which have investigated it, was discussed in the *Railroad Gazette* last week, and it was shown that the southern lines were in a position to lower their rates readily, if at any time New York competition should force them to do so. Disregarding entirely, therefore, the practicability of the proposed barge canal as a cheap carrier, and assuming that such a canal could and would carry grain as cheaply as its advocates believe, it seems profitable to study further the benefits which would accrue to New York under such conditions.

It is well known that grain which is exported from the country is carried either at cargo rates, when it forms the charter cargo of a vessel, or at berth rates, when it is used to fill space not required for merchandise. Grain in cargoes is the characteristic of the southern ports; the prevalent shipment of grain from New York is as berth freight, for the obvious reason that it is a convenient filler for ships other-

wise partially loaded. Berth rates are proverbially unstable, depending to a large degree upon the temporary demand for carriers or for cargo; while ocean cargo rates, although subject to frequent fluctuations, may be said at least to represent a fair value for service performed, since the profit to the carrier is derived in this case from a single source. It follows, then, that the port which does the most extensive business in other kinds of freight, and maintains the most lines of steamers, is naturally in a very advantageous position to export grain incidentally to the other business done. Its profit on grain carrying is often a by-product.

New York is pre-eminent in this respect. In the current issue of the "Journal of Commerce," for example, some 90 lines of steamers are advertised, reaching every part of Europe, and running also to islands in the Atlantic, to South America, India, China and Japan, Australia, South Africa, etc. If the southern ports are to receive any grain at all, they must make a substantial bid for it, and it is natural and perfectly legitimate for them to do so.

Suppose, then, that the voters of New York State authorize the carrying of grain from the great lakes to New York City at State expense, in accordance with the barge canal proposition, reduced to its actual terms. Baltimore, Philadelphia, and the other southern ports, with the railroad systems which reach them, must still have grain; therefore they must still maintain the differential which enables them to receive it. As before stated, the character of the port of New York in reference to the far-reaching business done there—the competitive principle of the commission's decision—gives New York an advantage so great that a differential is needed to equalize it. But the southern ports have advantages of a different character, which can be applied for effecting a material reduction in rail rates, should the occasion require it.

Terminal facilities of any kind whatever at New York require a great outlay of money, and even a small increase in business in a territory so congested calls for heavy additional expenditure. The difference in rate between Baltimore and New York does not serve as an inducement to the Baltimore & Ohio to ship grain to New York; it is more profitable to discharge it at the convenient Baltimore docks, instead of lightering it from Staten Island, with floats of freight cars distributed around New York harbor, and slow to return. If the proposed canal were ever successful as a rate cutter, therefore, it would be met by a group of railroads which could well afford to make material reductions to the southern ports; ports located far nearer the grain territory, with terminal facilities much less expensive to the carriers. Indeed, throughout the years when the differential was ordered, but not much observed, these railroads were able to keep far enough below New York cuts to maintain their business.

The current reduction in grain rates from Lake Erie to New York and Philadelphia illustrates another tendency sure to work against any material benefit which a lower rate might be expected to bring to New York. It has been followed by an instantaneous increase in ocean freights from New York, in spite of the protests of local interests. The rate to London has been advanced within the last few days from 1½d. minimum to 2d., and the same ratio holds to other foreign ports.

If the summing up of the two previous articles which the *Railroad Gazette* has printed on the canal question be sound (1) that the canal would be most unlikely to effect any reduction in the ultimate cost of transportation, and (2) that it ought not to if it could, it seems that a third statement may now be added, to the effect that it would make no eventual difference to New York City if it did.

August Accidents.

The condensed record of the principal train accidents which occurred in the United States in the month of August, printed in another column, contains accounts of 27 collisions, 26 derailments, and 6 other accidents. Those which were most serious, or which are of special interest by reason of their causes or attending circumstances, occurred as follows:

	Killed.	Injured.
1st—Greenwood, Ky.	5	3
3d—Hartford City, Ind.	..	21
†7th—Durand, Mich.	23	30
13th—McFarland, Kan.	1	3
14th—Nathrop, Col.	..	14
17th—Long Lake, Ill.	1	4
†22d—Chehalis, Wash.	2	33
23d—Little Falls, N. Y.	2	2
24th—Bloomington, Ill.	..	44
†24th—Fond du Lac, Wis.	1	22
†29th—Turners, N. Y.	1	17

In the worst collision of the month, that at Durand, the immediate cause appears quite plainly; but the explanation of just how the engineman allowed the air pressure to waste depends on circumstantial evidence. It is not insupposable that an engineman should neglect his air gage for a long time, even if he were awake; but most superintendents would in the present case direct their inquiry to the question whether or not Engineman Probst had been asleep. We give below such facts as we have been able to obtain, but there is nothing on this point, and no evidence as to the character, training, experience or record of the engineman. For this we shall have to wait for the Government accident bulletin.

The investigation of this accident showed that the two trains started from Charlotte, 51 miles west of Durand. The second section was made up of three stock cars, eight platform cars, four sleeping cars, two dining cars and a caboose. The stock and platform cars are very much longer than ordinary freight cars. The first stop was at Lansing, 19 miles, where the engine took water but was not cut off from the train. A short distance east of the tank the train had to cross over and run for a little distance on the westbound track. From this point to Durand, 32 miles, the train took about one hour for its trip. When about one and one-quarter miles short of Durand and running at about 30 miles an hour the engineman sighted the tail lights of the train ahead and at once attempted to apply the air-brakes. They did not respond and he then reversed his engine and sanded the rails, but in spite of his efforts the engine struck the caboose so hard as to toss it quickly off the track to the left, while the engine fell into the ditch on the right. The first car, loaded with elephants, then wrecked the rear sleeping car. The engineman, Probst, claims that the brakes worked all right at Lansing, but admits that he did not look at the air gage between Lansing and Durand.

The air-brake and the engineer's brake valve were found in perfect condition. The pump governor had been broken and that part of it which contained the diaphragm could not be found, although it was carefully searched for. The union, by which the air pipe is connected to the governor, was found, and its condition indicated that the governor must have been unscrewed from it. Engineman Probst, it appears, claimed that the governor must have failed; but there is no evidence of this and there is definite evidence that it had been carefully examined in the shops and was in good order only six days before the collision. The governor was one of the kind known as the "improved type."

Probst's fireman testified at the inquiry that immediately after the attempt of Probst to apply the brakes he looked at the air gage and found the black hand, indicating train pipe pressure, at zero, while the red hand, indicating the pressure in the main reservoir, indicated 90 lbs.; and he said that the pump was running at the time.

Concerning the possibility that the train pipe may have been stopped at the rear of the tender, by the angle cock being closed, or by any other cause, it appears that the air-brakes were as ineffective on the engine and tender as on the cars. When the engineman reversed his engine the driving wheels revolved backwards; with the sand on the rails, if the driver brakes had been then applied the wheels undoubtedly would have slid. The tires were searched for flat spots but none were found.

The cars in the train were examined and the air-brake apparatus found in better than average condition.

Considering all the facts, the conclusion was reached that Engineman Probst must have left his brake valve on lap the last time he used it, which appears to have been at Lansing. This may have occurred when he stopped for water; he may have left it thus expecting to make a further application and then have found it expedient to make his final stop by reversing the engine.

Three of the accidents listed above occurred on roads worked by the block system. The collision at Greenwood seems to have been a shining example of the failure of double safeguards. It appears to be the rule everywhere, on single track roads which are equipped with automatic block signals, to treat opposing trains precisely the same as though no block system were in force; the time-table, supplemented by the despatcher's orders, remains supreme. But what if the supreme reliance fails? It would be interesting to know how far the existence of a second safeguard leads to relaxation in the maintenance of the first. When an engineman sees an automatic signal showing the stop or caution indication he thinks, first, of the indication, and second, of the cause of it; and many enginemen appear to have the vicious mental habit of concentrating their attention on the second thought. Only by constant and rigid discipline is it possible to correct this habit or to prevent some enginemen from running into danger by taking chances on the signal indication; from acting on the chance that the opposing train is farther away than it really is.

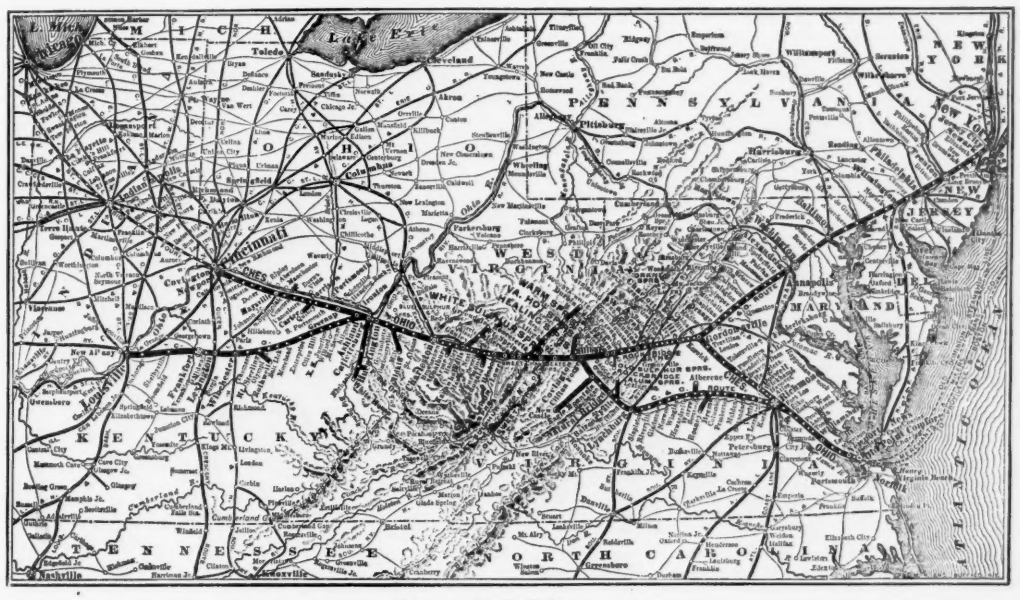
Long Lake is on a road which has had manual block signals on its single track lines for 10 or 15 years; and Turners is on a line where the Sykes apparatus is supposed to be in use.

The McFarland accident is a sample of a considerable number of cases in the West in August, occasioned by extensive floods. The Little Falls derailment appears to be an almost exact duplicate of the derailment on another great railroad one year ago (July, 1902). In the Bloomington collision a carload of passengers was upset, and many of the persons injured, by what may be called a combination of a defective coupler, bad judgment in regulating speed in approaching a crossing and non-use of air-brakes; but no one need spend time in weighing the elements of the combination, as the last one of the three may just as well be taken as the sole cause. If the air-brake had been coupled up and in use the collision undoubtedly would not have occurred.

The number of electric car accidents in August was 15, in which eight persons were killed and 103 injured.

Chesapeake & Ohio.

The report for the year ending June 30 shows a considerable increase in passenger earnings, a decrease in freight earnings, and a small increase in gross receipts. The latter is more than counteracted, however, by a large increase in conducting transportation, due to the higher cost of labor and materials. The report is of especial interest owing to the peculiar conditions governing the company's operation. The item of grain, which originally supplied the chief freight tonnage of this road, has been gradually disappearing until to-day the coal and coke industry furnishes about 50 per cent. of the company's total freight tonnage. The benefit derived from an increase in tonnage of this sort has been steadily growing, owing to the progressive increase in rates. In 1889 these rates fell to the low level of 2.21 mills per ton-mile on coal, and 4.37 mills on all other freight. The ton-mile rate for coal during the past year was 3.33 mills, an increase of 8.5 per cent. over 1902, and the ton-mile rate on other freight was 5.96 mills, an increase of 13.7 per cent. The decrease for the year of 1,636,936 in the total number of tons of coal and coke carried, and the decrease in earnings of $1,503,734 from the same source, are due, as President Stevens says, mainly to the coal miners' strike in the West Virginia coal territory. This decrease is also made more evident by issuing a report at this time of the calendar year, before the company has had time to fully recuperate from the effects of the recent trouble.


Lake Erie
Toledo
Cleveland
Akron
Cincinnati
Columbus
Pittsburg
Harrisburg
Williamsport
Scranton
Wilkesbarre
Allentown
Easton
Trenton
Reading
Lancaster
Baltimore
Washington
Richmond
Norfolk
Petersburg
Lynchburg
Roanoke
Charleston
Huntington
Ashland
Parkersburg
Clarksburg
Grafton
Cumberland
Hagerstown
Martinsburg
Winchester
Alexandria
Fredericksburg
Gordonsville
Charlottesville
Staunton
Clifton Forge
Covington
Hinton
Kanawha Falls
White Sulphur Springs
Hot Springs
Warm Springs
Healing Springs
Old Point Comfort
Newport News
Portsmouth
Suffolk
Franklin
Emporia
Lexington
Louisville
Frankfort
Versailles
Paris
Maysville
Ashland
Nashville
Knoxville
Bristol
Abingdon
Pulaski
Radford
Roanoke
Lynchburg
Danville
Greensboro
Salisbury
Statesville
Asheville
Spartanburg
Greenville
Columbia
Charlotte
Hartsville
Florence
Wilmington
Hamlet
Raleigh
Goldsboro
Weldon
Rocky Mount
Tarboro
Kinston
New Bern
Morehead City
Elizabeth City
Edenton
Winston-Salem
Mt. Airy
Lenoir
Morganton
Hickory
Marion
Old Fort
Black Mountain
Tryon
Saluda
Hendersonville
Flat Rock
Brevard
Rutherfordton
Forest City
Shelby
Gaffney
Blacksburg
Kings Mountain
Gastonia
Lincolnton
Newton
Concord
Salisbury
Mooresville
Statesville
Taylorsville
Hickory
Newton
Conover
Catawba
Claremont
Maiden
Lincolnton
Gastonia
Kings Mountain
Shelby
Rutherfordton
Spindale
Forest City
Marion
Old Fort
Black Mountain
Asheville
Tryon
Saluda
Hendersonville
Flat Rock
Brevard

expenditure fund of $410,387, the sum of $1,001,399 was subtracted for extraordinary expenditures. Of this amount $405,899 was spent in filling trestles and changing the line on the Richmond & Allegheny, and the Lexington & Big Sandy branches, and $392,925 represents a cash payment on trust certificates "B" and "C" in excess of the amount covered by the certificates. The 25 freight engines and 3,210 freight cars covered by these two certificates were delivered during the autumn of 1902. A sum of $579,503, representing monthly payments on equipment contracts, was charged to operating expenses, in accordance with the policy of the company, as stated in the report.

Increases in the items of maintenance of way were comparatively light, but there was a large increase of $575,119 in conducting transportation. This was due mainly to an increase of $446,299 in the cost of fuel purchased, and to a general increase in the cost of labor. This advance in the cost of materials and of labor has been evident in all the railroad reports which have been issued so far this year, and has caused a widespread increase in operating expenses.

The changes in transportation are clearly summarized by President Stevens as follows: "Coal and coke tonnage decreased 27.4 per cent.; other freight tonnage increased 5.7 per cent.; the total tonnage handled showed a decrease of 12.4 per cent. Revenue ton-miles decreased 17.6 per cent., but the revenue per ton per mile was 4.75 mills, an increase of 18.2 per cent. The average trainload was 493 revenue tons, a decrease of 3.1 per cent. The average trainload, including company's freight, was 524 tons." The extreme decrease in revenue ton-miles for the year is a natural consequence of the fact that during the strike all the coal roads were compelled to supply coal in their immediate territory and could not look after the needs of the more distant markets. The average distance each ton was carried during the year was 276 miles, a decrease of 5.8 per cent. For the last half of the fiscal year, however, a period not affected by the strikes, 5,527,399 tons were moved, an increase of 3.4 per cent. The ton mileage was 1,545,003,170, an increase of .2 per cent., and the average trainload was 528 revenue tons, an increase of 6.7 per cent. Total freight earnings for this period also showed an increase of $873,789.

The funded debt was increased to $73,651,354 by the issuance of $2,000,100 4½ per cent. general mortgage gold bonds. The proceeds were used for purchasing stock of the Guyandot Valley railroad; for additional improvements at Richmond, and for building a number of small extensions. The regular dividend of 1 per cent. was paid on the $60,529,900 outstanding common stock. This left a balance of $73,294, which was transferred to the credit of profit and loss, making a total balance in the profit and loss account of $1,071,106. The company has planned a number of improvements and extensions for the ensuing year on the Cabin Creek, Guyandot Valley, Piney Creek and Big Sandy branches for the purpose of developing rich coal properties.

The following table shows increases in gross earnings for the past five years.

Year ending June 30.	Gross earnings.	Miles operated.	Average per mile of road.
1899	$12,009,839	1,449	$8,288
1900	13,402,070	1,476	9,080
1901	15,371,542	1,507	10,200
1902	16,524,379	1,618	10,213
1903	16,711,601	1,637	10,209

Below is a summary of the more important statistics of operation for the fiscal year of 1903, as compared with 1902.

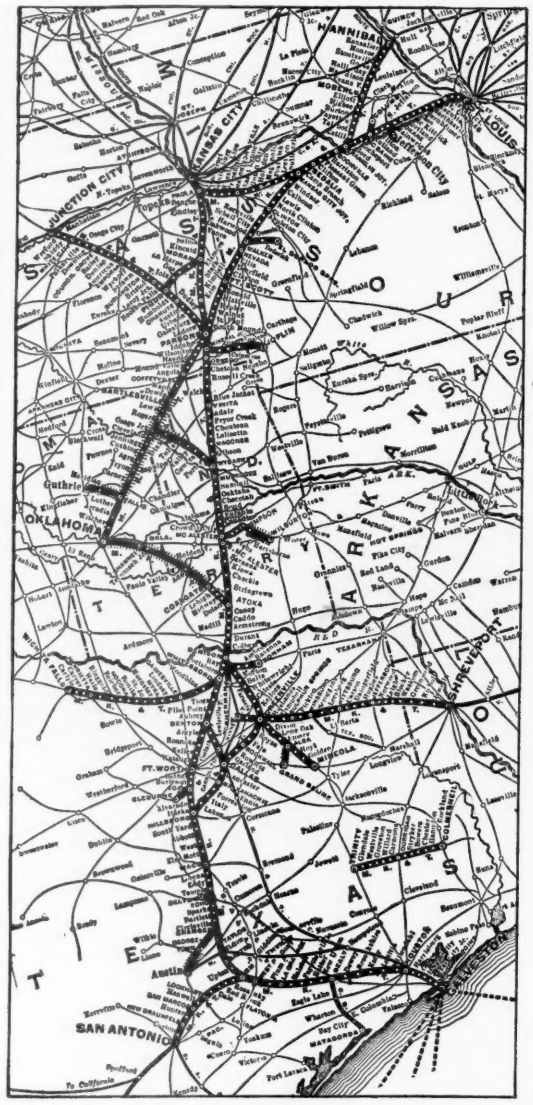
Earnings—	Year ending June 30, 1903.	Year ending June 30, 1902.	Net change.
Passenger	$3,474,905	$2,954,919	Inc. $519,986
Freight	12,510,006	12,833,806	Dec. 323,800
Mail and express	613,885	592,743	Inc. 21,143
Miscellaneous	112,805	142,910	Dec. 30,105
	$16,711,601	$16,524,378	Inc. $187,223
Operating expenses—			
Maint. of way	$2,178,835	$2,175,876	Inc. $2,959
Maint. of equip.	2,679,021	2,669,292	Inc. 9,729
Conducting transp'n.	5,839,230	5,264,112	Inc. 575,119
General expenses.	355,636	289,213	Inc. 66,423
Total oper. expenses.	$11,052,722	$10,398,492	Inc. $654,230
Net earnings	$5,658,879	$6,125,886	Dec. $467,007

Missouri, Kansas & Texas.

The report for the year ending June 30 shows an increase in gross earnings of $816,793, and an increase in net earnings of $240,868. As this is on an average mileage operated of 2,601, as against 2,500 in 1902, there is a slight gain per mile in both gross and net receipts. Passenger earnings increased $119,613, while freight earnings showed a gain of $624,208. The earnings per ton per mile were .959 cents against .904 cents the previous year, and ton miles also increased from 206.4 revenue tons to 211.2. The report says the increase in freight rate is due to a better understanding between the competing lines, brought about by the injunction of the United States court to maintain a system of legally published rates.

Operating expenses for the year were $12,123,131, showing increases of $287,392 in conducting transportation, $152,504 in maintenance of equipment, and $134,707 in maintenance of way. During the year, 33 locomotives and 1,139 miscellaneous cars were delivered to the company, while 56 locomotives, 963 box and 63 coaches are now under contract. An appropriation of $1,160,847 was made from net income to cover cash payments on new equipment purchased during the year, and upon notes maturing for previous purchases. The character of the maintenance improvements in 1903, as enumerated in the report, include: 23 miles of embankment made standard width; 21 miles of change in alinement; 76 miles of new ditching; 165 miles of track ballasted; 245 miles of new rails substituted for old; six new steel bridges in place of wooden structures; 36 miles of side track and numerous additions to shops, stations, etc.

The funded debt was increased $633,000 during the year, by the issuance of bonds to the amount of $828,000, to pay for newly acquired lines, and to retire the outstanding bonds of the Tebo & Neosho and the Missouri, Kansas & Eastern railroads. The company acquired by purchase the Granger, Georgetown, Austin & San Antonio, 15½ miles long, and is operating, under a special contract, the Dallas, Cleburne & Southwestern, 10 miles. One hundred and thirteen miles of the Oklahoma City—



Missouri, Kansas & Texas.

Guthrie extension have been completed, and it is expected that the track will all be laid by the end of the calendar year. This extension will give the Missouri, Kansas & Texas a short route from Oklahoma and Indian territories to Kansas City, St. Louis and Chicago, and will add to its freight traffic. The more important details of the income account for the past two years follow.

	1903.	1902.
*Average miles operated	2,601	2,500
Freight earnings	$13,256,900	$12,632,692
Passenger earnings	3,160,455	3,040,842
Gross earnings	17,208,192	16,391,399
Maintenance of way	2,779,995	2,645,289
Maintenance of equipment	1,651,077	1,498,573
Conducting transportation	6,913,309	6,625,917
General expenses	778,750	777,427
Net earnings	5,085,062	4,844,194

*The total mileage now under operation is 2,713 miles.

Passenger Transportation in New York.

The Committee on Engineering and Sanitation appointed by the Merchants' Association of New York has published a 216-page report on the passenger transportation service in the city. In December, 1902, the Merchants' Association called a public meeting and organized a number of committees for investigation and action on the evils of over-crowded and unsanitary conditions alleged to exist in the street and elevated cars in New York City. The Merchants' Association finds fault with the State Railroad Commission in that the report made by it upon this topic following the Association's complaint, showed no data of passenger car movement sufficient to warrant the conclusions reached; that the recommendations of the State Commission were based upon imperfect knowledge of the facts and in consequence were only partly adapted to the necessities of the case. In the present report the problems attending passenger transportation in New York are studied at some length and a number of diagrams are printed showing traffic movement and congestion in the streets at different times of day.

The problem of running more and larger cars on crowded surface lines seems to the committee to be the most important one now up. This is intimately connected with the problem of regulating vehicle traffic upon the streets, and observations were taken at numerous points of congestion by way of ascertaining the possibilities of the situation. The committee believes that under existing conditions it is possible to run 200 cars an hour each way on streets like Broadway and it holds that the present service is insufficient, particularly during the times of relatively slack traffic on the lines. But the claim of the Interurban Company that the best possible service is given during the rush hours, and that the numerous vehicles on the streets render the running of more frequent cars an impossibility, is given serious consideration, and the Committee believes that, in any case, the contention of the street railroad is so sufficiently well founded that the city authorities cannot well press a demand for much better service until the city shall first have done all in its power to remove the obstructions complained of. Of these, the chief is the practice of permitting vehicles to stand along the curb, compelling every moving vehicle on the same side of the street to turn out and go around, thus obstructing the cars. A number of counts were made of the vehicles lined along the curb on each side of Broadway between Battery Place and 34th street, and the average of seven trips at different times of day showed over 250, which is equivalent to one vehicle standing along the curb for nearly every 50 ft. of the whole curb distance on both sides. On the streets further west, the conditions are considerably worse than on Broadway. The Committee considers that existing ordinances are sufficient to abate this cause of obstruction and delay, if they are enforced.

The report also contains chapters advocating larger cars, power brakes and improved sanitation, in addition to which a large number of topics of greater or less importance are separately treated. Taken as a whole, the document shows a careful and commendable effort to grapple with a large and serious problem, and if the conclusions and results reached are not as definite and helpful as might have been wished, full credit should nevertheless be given for an effort obviously in the right direction. The Committee does not feel that it has by any means exhausted the subject, and says in its conclusion that it has only been able to touch upon the most salient features of a most intricate and comparatively unstudied branch of engineering. The study of the tides of humanity, their ebb and flow under urban conditions and with enormous and complicated transportation facilities, has only just begun to be possible, and their modes of action have not as yet been crystallized into formulæ whereby results can be readily foretold.

The report is signed by S. Whinery, Chairman; H. W. Brinkerhoff, Foster Crowell, C. H. Myers, George A. Soper, and F. F. Woodward, Secretary.

NEW PUBLICATIONS.

The Permanent Way Pocket Book. By T. W. Jones. Second edition revised by R. Young. Calcutta: Thacker, Spink & Co., 1903. 187 pages.

This little book contains in convenient form the rules and formulæ for the construction and maintenance of permanent way based on Indian and Colonial practice. It is intended primarily for the unskilled men employed on Indian railroads, and as such has a value. The formulæ are made as simple as possible. In most cases a knowledge of arithmetic is all that is needed to apply them, though reference is made to trigonometrical tables a few times. There is much useful general information, including tables and data. In revising the original work information on engines, boilers, hydraulics, electric lighting, lifting tackle, tools, etc., has been added.

TRADE CATALOGUES.

"*Industrial Mississippi;* With Special Reference to the Gulf & Ship Island Railroad." This is a 60-page pamphlet issued by Fisk & Robinson, Bankers, of New York and Boston. It was written by Elisha Walker, and is illustrated with a number of maps and photographic reproductions. Considerable space is given to the possibilities of the State of Mississippi as yet undeveloped, together with an account of the rebuilding of the Gulf & Ship Island railroad and the building up of the country through which it passes. The book treats principally of the southern part of the State, known as the Long Leaf Pine Belt, but also discusses at considerable length other parts of Mississippi, and gives statistics of its growth since 1880, in both farming and manufacturing

Catalogue Number Four of the Carborundum Company, Niagara Falls, N. Y., is complete in the information given on the manufacture and development of carborundum and its various products and uses. The rapid growth of the industry is well shown in the frontispiece, which contains views of the 1893 plant and of the 190

works. Applications of carborundum have been made in practically every form that an abrasive can be used, from razor hones to heavy grinding wheels, and from carborundum cloth to grinding drums for leather. The book shows a large number of half-tone sections of special shapes of wheels for universal grinding machines. The pamphlet is artistic in get-up and is printed on heavy enamel paper.

Record of Recent Construction No. 44 of the Baldwin Locomotive Works contains the usual full-page half-tone illustrations, and general dimensions, of 11 representative examples of their recent output. There are also three examples of special types, comprising two inspection locomotives and a double-ender for logging service.

The Chicago & North Western has sent out an artistic illustrated folder commemorative of the Chicago centennial celebration. Photographs and descriptions of places of prominence in Chicago and vicinity are given together with a railroad map and brief description of the North Western train service.

The Chicago Pneumatic Tool Company has issued circular No. 42 showing the Chicago plug drill, stone hammers, rock drills, air compressors, drills, riveters and hammers.

The Aurora Metal Company, Aurora, Ill., has issued a little pamphlet describing the Lewis and Kunzer metallic packing and packing case.

Westinghouse Electro-Pneumatic Turret System of Control.

The announcement was made in the *Railroad Gazette*, on May 15 last, that the Westinghouse Air-Brake Co. had equipped the experimental car John B. McDonald, of the Interborough Railroad, New York City, with a new system of electro-pneumatic train control. At the Saratoga convention of the American Street Railway Association this month a complete apparatus for one car in working order was exhibited for the first time. Following this, the details of the system are now given. The principal parts of the apparatus and their location and connections are shown in the accompanying engravings.

The new system operates on the same principle of electro-pneumatic control as is used in the original Westinghouse system. The method of accomplishing the movements of the main controller under each car is, however, radically different. All of the safeguards of the old system have been embodied in the new and with some additional ones. Current is taken from the track circuit and after passing through a lamp resistance is used for charging storage batteries from which the power is taken for controlling the pneumatic switches in the main circuits. The control leads carry only 14 volts, which eliminates danger from short circuits and accidents in coupling the wires from car to car in the train. By using storage batteries the control circuits are independent of the track circuit and the motors can be manipulated even if a fuse is blown out or the third-rail de-energized. Compressed air for operating the pneumatic valves and switches is taken from an auxiliary reservoir connected through a feed valve to the air-brake train pipe. A check valve in the connecting pipe assures at all times a sufficient supply of air to provide against failure of the brake system so that both controlling current and operating power for the main switches are independent of any other apparatus under the car. The controller and reversing handles are interlocked and cannot be moved unless they are both in their proper positions of off or ahead or reversed. The controller handle has an automatic spring return to shut off the current in case of accident to the motorman, and is also connected to the brake system to apply the brakes when such an automatic cut-out is made. Power cannot be applied to the motors when the brakes are on or the brakes applied when the power is on. This is accomplished by the introduction of a pneumatic cut-out switch in the battery circuit which is connected to the brake cylinder and which opens whenever there is air pressure in the cylinder. The apparatus hereafter described is for one car only, but of course the control of any number of cars in a train is possible by conducting the battery wires from any master controller to all the turret controllers under the cars through a train cable. This cable consists of only seven wires carrying 14 volts so there is little complication and no danger from high tension currents.

The apparatus for one car consists of a main controller, reversing switch, limit switch, resistances, two master controlling switches, 14 cells of storage battery, reducing valve, circuit breaker relay, supplementary reservoir, four 7-point receptacles and three junction boxes. As applied to the cars of the Interborough, the total weight for each car is 1,711 lbs., exclusive of wiring and insulation. With the exception of the master switches, battery switches and junction boxes, all of the apparatus is supported from the floor under the car. The main circuit wires are carried up into the car at only one point, connecting to a main switch in one of the motorman's compartments.

In the motorman's cab at each end of the car, the master control switch with the brake valve alongside, are mounted on the end panel. The master switch shown with the cover removed in Fig. 1 is mounted with the handle 34 in. above the floor, or about level with the window sill. It is 7½ in. high, 6 in. wide and but 4½ in. deep, so that when not in use the door of the compartment may be swung back against the end panel and enclose the whole apparatus. The rotating cylinder is hard wood with copper plates and spring fingers. The battery circuit wires are brought out through the bottom of the switch box and down the panel to a junction box 13½ in. high, 5 in. wide and 3 in. deep, from which they pass through the floor to the pneumatic switches under the car and to the coupling plugs to the other cars in the train.

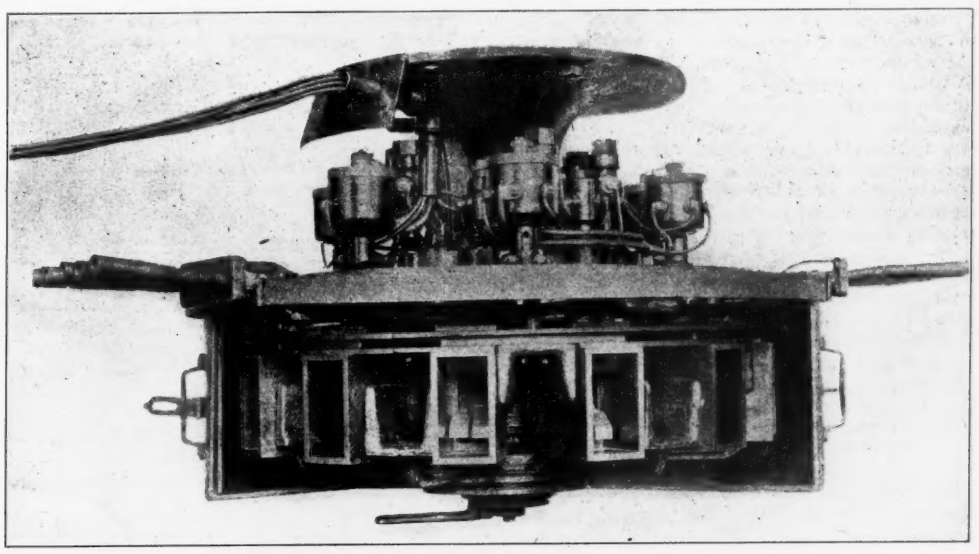


Fig. 4—Turret Controller, Cover Removed.

Fig. 3—Turret Controller, Cover On.

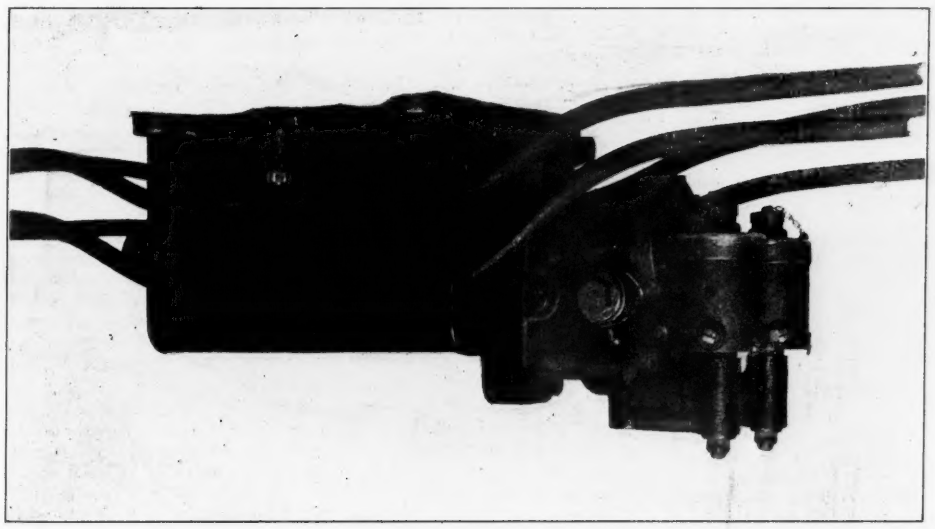


Fig. 7—Reversing Switch, Cover On.

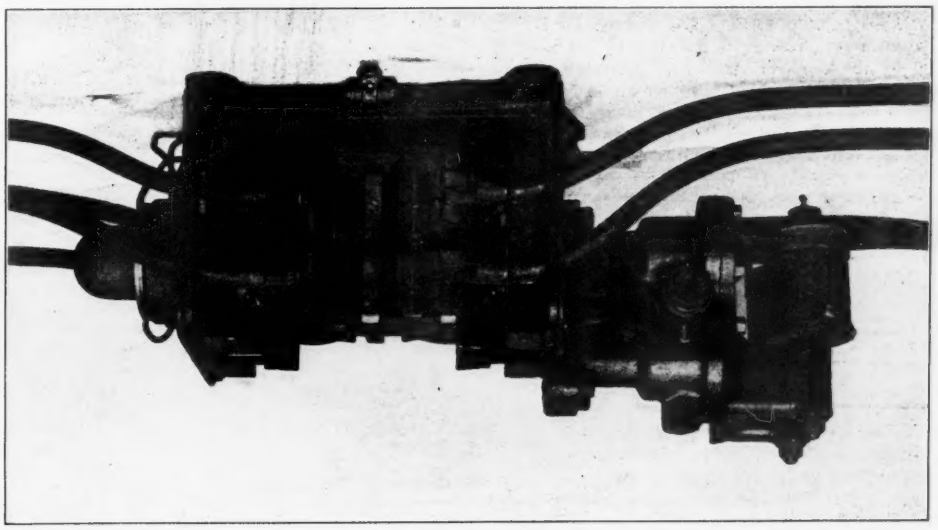


Fig. 8—Reversing Switch, Cover Removed.

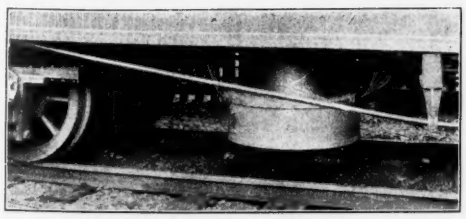


Fig. 2—Turret Controller Mounted Under Car.

The main controller, Fig. 2, is hung from the floor of the car as near the truck as possible to save wiring. The system takes its name of "turret" from the appearance of the cover as shown in Fig. 3. Fig. 4 shows the controller with cover removed. Thirteen switches operated by air and controlled by magnetic valves, Fig. 5, are mounted around a central casting which serves as a reservoir to supply air to the pistons. These pistons operate against 70 lbs. spring pressure, which insures a positive break to the switches and also allows any length of break necessary to prevent arcing. The 13 switches have one common blow-out coil located in the center of the turret. The arc is blown out radially since the mag-

netic field is horizontal due to the pole pieces for the blow-out being formed by the arms of the spider supporting the switches. The contacts of the switches cannot weld or stick under the strong positive air pressure moving them, and by making the finger levers flexible there results a slight rubbing of one contact surface over the other which further prevents any welding or roughness. Several of the switches move together so that only eight pneumatic cylinders and valves are required for making all the necessary contacts. The section of the controller, Fig. 6, shows the arrangement and general dimensions of the valves and switches.

Figs. 7 and 8 show the reversing switch with cover on and removed. This is mounted under the car, near the truck, and is of the reciprocating type with copper contacts. It is operated by two pneumatic valves admitting air on opposite sides of a piston, and connected to the reversing handle of the controller. A limit switch is placed in the battery circuit which prevents the controller valves from opening in too rapid succession and causing a rush of current to the motors. This valve is mounted near the reversing switch, both being on the opposite side of the car from the resistance.

The wiring diagram, Fig. 9, shows the connections for one car. The switches 1 to 13 are controlled by the solenoids shown above them. Nos. 1 and 2 work together and control the circuit breaker. Nos. 3 and 11 together make the series connections, and Nos. 5 to 10 act successively through the limit switch in cutting out the resistance on the third notch of the master controller. Nos. 13-4-12 open switches 3 and 11, cutting out the series connections and throw the motors into multiple, then pick up the resistance controlled by 6, 7, 8 and 9, until the maximum speed is reached. The car being at rest, the movement of the master controller handle to the first notch from the "off" position, closes the battery circuit through the reverser, moving that switch to the position controlled by the contacts made with reversing handle. This closes the circuit-breaker relay circuit and actuates the pistons 1 and 2 through to the coil shown above them, which movement closes the circuit-breaker. The next step closes the connection between rheostat R_1, or maximum resistance and the motors, and at the same time makes the necessary series connections through 11 and 3. The third step cuts out the resistance by bringing switches 5 to 10 successively into play, each switch as it closes, closing the battery circuit for the next valve. Holding coils shown above each piston cut out the limit switch after each main switch has closed and prevent the limit switch releasing the contacts already made. The limit switch may be set to give any required acceleration and acts automatically in opening the battery circuit and preventing the pneumatic valves from opening too rapidly and burning out the motors with a sudden rush of current. The fourth step, or multiple position, closes switches 4, 12 and 13, and these in closing open 3 and 11 and establish a circuit through the holding coils of 6, 7, 8 and 9. The resistances controlled by these switches are then picked up in succession until maximum speed is reached.

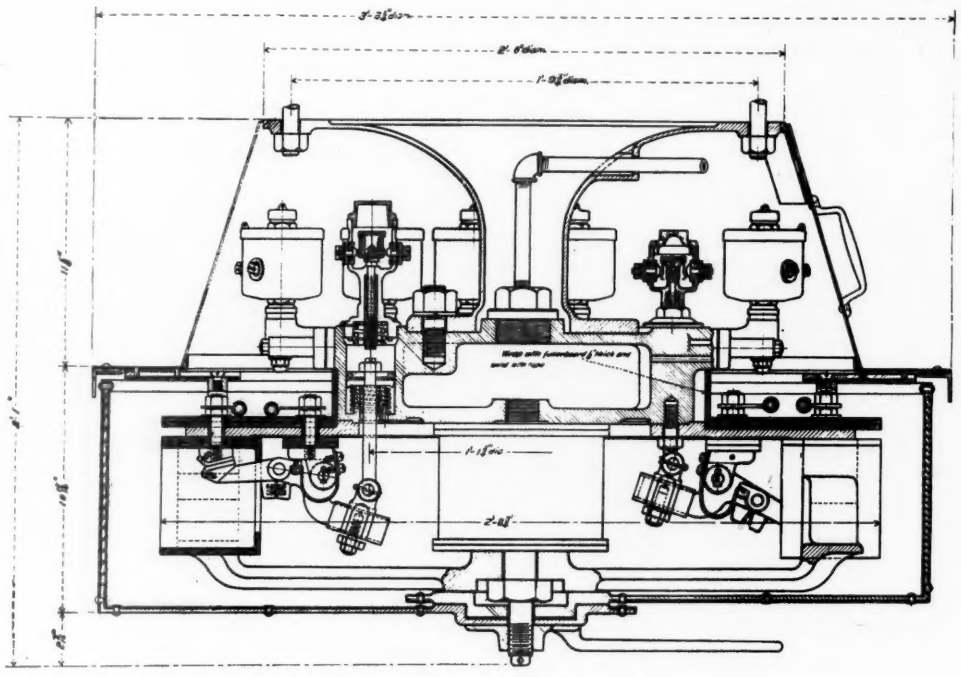


Fig. 6—Section Through Turret Controller.

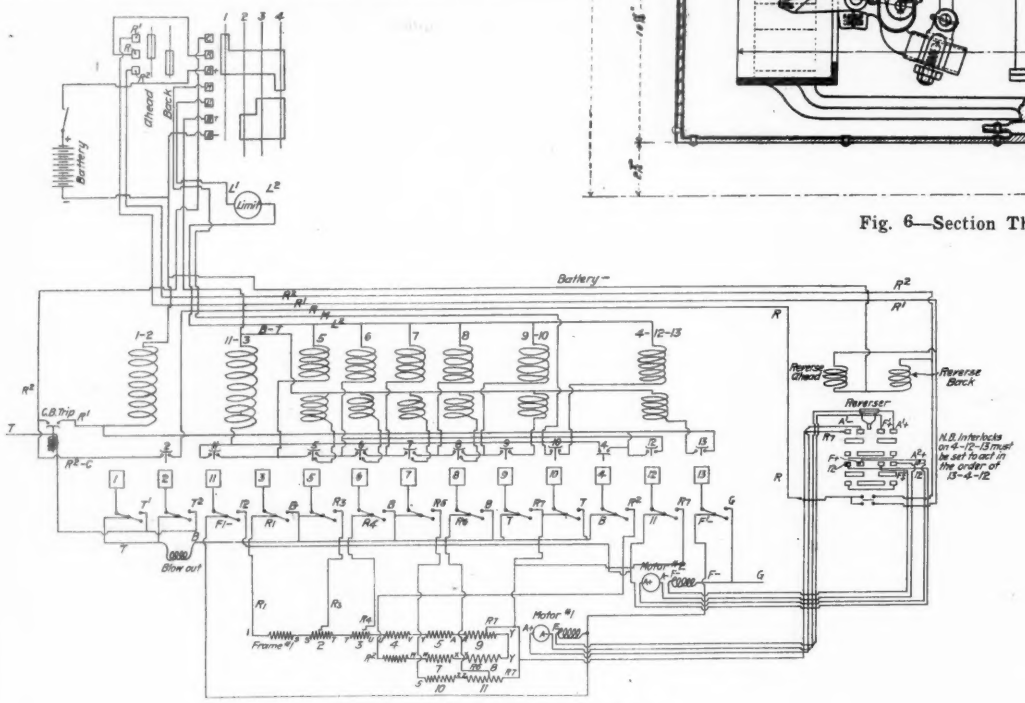


Fig. 9—Wiring Diagram for One Car.

The storage batteries used consist of two sets of seven cells each, type D-5 batteries of the Electric Storage Battery Co. They are enclosed in a box under the car and weigh complete 300 lbs. They are charged at night when the lamps are on, and either is sufficient to supply current for the day's run. All of the wiring in the car is enclosed in electro-asbestos conduits to guard against fire.

Foreign Railroad Notes.

Early this summer the completion of the Albula Railroad gave the first railroad approach to the much frequented Engadine valley in Switzerland. The diligence road by which travelers theretofore had entered the valley was one of the most frequented in Switzerland; but with the completion of the railroad all the diligences were taken off. The last one going out displayed mourning; a procession with a band playing a funeral march accompanied it, and on reaching St. Moritz the church bell was tolled.

The German Society of Locomotive Engineers has built a "convalescents' house" at Münden at a cost of about $62,000. It has 45 rooms for patients, and good provision for their comfort and recreation. It is expected that the cost of board in it will not be more than 50 to 75 cents per day.

It is announced that a locomotive built in Munich is now hauling trains (chiefly construction trains) in the Land of Canaan—not Canaan, Conn., nor Canaan, N. Y., but the original Canaan "beyond Jordan," penetrated by the Haifa & Damascus Railroad, which the Germans are building. They are putting up a stone arch bridge over the brook Kishon, and talk of getting the track through this year past a signal station at Nazareth. But perhaps the earth will open and swallow the whole thing by that time.

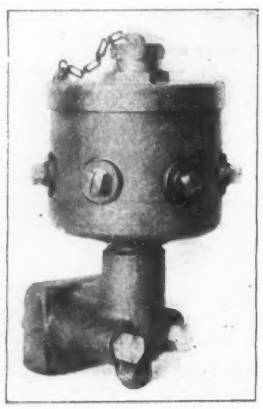


Fig. 5—Electro-Pneumatic Valve.

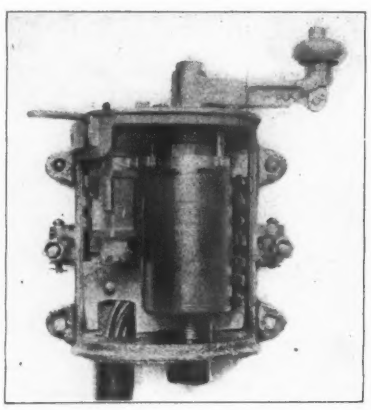


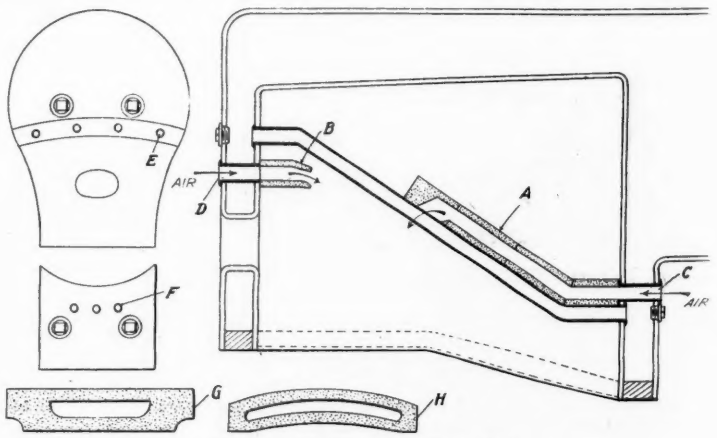
Fig. 1—Master Controller Switch, Cover Removed.

The Wade-Nicholson Hollow Arch.

Perfect combustion not only results in fuel economy but it also prevents the nuisance of black smoke. There are many so-called "smoke consumers," but the designers of many of these devices have overlooked or failed to recognize the fundamental principles of combustion. Smokeless combustion can be obtained if the requisite amount of oxygen is supplied to combine with the carbon and volatile gases in the fuel. Where rates of combustion are low and the grate area is large, enough air can be drawn through the grates to oxidize the fuel without the formation of black smoke—provided the fuel is not heaped on the grates so as to smother the fire. But in a locomotive, the conditions require that large quantities of fuel be burned on a relatively small surface—conditions opposed to economical combustion.

The burning of coal consists of several processes. First: The hydro-carbon gases are driven off. Second: The carbon is oxidized to carbon dioxide ($C O_2$) or to carbon monoxide ($C O$), depending on whether combustion is perfect or imperfect. By the usual method of burning coal on the grate of a locomotive, all the air must be drawn through the grates. If the supply of air is restricted the combustible gases pass through the fire-box and tubes and out of the stack without giving up all of their heat to the water in the boiler. These gases are at a high temperature and would ignite if oxygen in sufficient quantities could be introduced into the fire-box above the grate.

The above is in brief the theory upon which the Wade-Nicholson hollow arch is designed. The accompanying illustration shows the general arrangement of this type of arch in the fire-box of a locomotive. The back arch (A) is built up of brick sections similar to H. The arch rests on water tubes extending from the tube sheet



The Wade-Nicholson Hollow Arch.

to the throat sheet. Metal tubes (C) extend through the front water leg and put the interior of the arch (A) in communication with the outside air. Similar tubes (D) extend through the boiler over the fire door and terminate inside the fire-box in the arch (B) made up of sections similar to (G). When the engine is at work air is drawn through the grate and also through the arches A and B. The air in passing through the arches becomes highly heated which facilitates the combination of the oxygen with the hydro-carbon and other gases. The air from the arches passes into the fire-box in such a manner as to produce a whirl, which, it is claimed, assists in mixing the air and gases.

These arches are used on several classes of locomotives on the Chicago & North Western. It is claimed that their use has decreased the quantity of cinders which accumulate in the front-end and in the lower rows of tubes. The following record of fuel consumption was kept by Mr. E. H. Wade, Assistant Master Mechanic, and covers the month of August for 1902 and 1903. In 1902 the arch was not used. Engine No. 400 is a 10-wheeler and engine No. 673 is an 8-wheeler.

Engine 400.

Month, August.	Mileage.	Tons of coal.	Av'ge miles per ton.	Ton mileage.	Lbs. of coal per 100 ton miles.	Av'ge train load. tons.
1902.....	4.291	264	16.3	622,200	84.88	145
1903.....	2,844	140	20.0	474,900	58.94	167
Engine 673.						
1902.....	2,637	118	22.3	427,200	55.26	162
1903.....	3,047	108	28.2	466,200	46.35	153

The saving, as shown by the pounds of coal per 100 ton miles, is 30.6 per cent. and 16.1 per cent. for engines Nos. 400 and 673 respectively. The Brush Lubricating System, Chicago, is selling the arch.

TECHNICAL.

Manufacturing and Business.

The Goldy Machine Company, Camden, N. J., has been incorporated with a capital of $1,000,000, by Henry D. Mathews, Samuel N. Goldy and others.

The Independent Railroad Supply Company, The Rookery, Chicago, has recently shipped to the Buffalo, Rochester & Pittsburg several carloads of "Chicago" four flange tie plates.

Mr. J. H. Setchel, hitherto Western Representative of the American Locomotive Co., will after October 1st be Sales Manager for Jerome & Elliott, Chicago, makers of Jerome metallic packing and McIntosh blow-off cocks.

The Kentucky Gear & Machine Company has been incorporated and has plans prepared to build a factory in South Louisville to make patent gear cutting machines and gear wheels. Geo. Vinder, of Louisville, is one of the incorporators.

The Chicago Pneumatic Tool Company denies the rumors that President J. W. Duntley is to resign. The executive offices are to be removed to New York, and for that reason Messrs. C. H. Wacker, W. J. Chalmers and J. A. Lynch have resigned from the Board of Directors.

The Monterey Machine Works has arranged with the American Brake Shoe & Foundry Company to manufacture its specialties. The American Brake Shoe & Foundry Company has a number of orders for brake-shoes for use on the Central South African Ry., also some for use on British railroads.

The Federal Engineering & Construction Company has been incorporated in New Jersey and will have its principal offices in Jersey City, with a capital of $125,000, to do general engineering and construction work. C. Brosius Reed, W. Riley Weaver of Baltimore, Md., and F. P. McDermott of Jersey City, are incorporators.

A contract has been let to Edward Brady & Co., of Baltimore, by the Baltimore & Ohio, for still further increasing the capacity of the Mt. Clare shops, at a cost of about $85,000. There will also be an addition of nearly $100,000 worth of machine tools, which have already been bought. The capacity of these shops has been more than doubled during the past six years.

The National Fidelity Warehouse Company has been incorporated in Virginia, with a maximum capital stock of $1,500,000, and will have its principal office in Richmond. The company proposes to establish warehouses at Richmond and Norfolk and many points in the South. It also intends to secure incorporation in most of the Southern States where warehouses will also be located. The incorporators are Baltimore capitalists, including Wm. Penn Lewis, President and Director; Thomas E. Wittell, Secretary and Director, and E. B. Thomason, of Richmond.

Mr. W. M. Kinch, formerly Signal Engineer of the New York Central and, before that, for a number of years on the Pennsylvania Railroad, is now connected with the Gordon Battery Company, of New York City, maker of the Gordon primary battery for railroad signal work and for other uses. Mr. Kinch is in the commercial department. He has an extensive acquaintance with railroad men, which, with his long experience in signal work, must well fit him for his new position. His headquarters will be at the company's office, 439 East 144th street, New York City.

The National Car Wheel Company has been incorporated in New York, with a capital of $9,000,000. The principal offices will be located in Rochester, N. Y. The Directors are: Charles T. Chapin, President of the Rochester Car Wheel Works, and Frank D. Russell, Vice-President of the same company; Charles A. Maher, of Cleveland, Ohio; Charles V. Slocum (President of the Keystone Car Wheel Company, Pittsburg, Pa.); Howard C. Smith (broker, 45 Wall street, New York); Forsyth Wickes (lawyer, 49 Wall street, New York), and Beverley R. Robinson (lawyer, 49 Wall street, New York city).

The Taylor Signal Co., of Buffalo, N. Y., has opened a New York office in the Broad Exchange building, Broad street. Mr. W. G. Hovey, the Eastern Agent, is a man of unsuual ability, experience and training for this position. For many years he was superintendent of signals on the Chicago & North Western, but he has been for more than three years superintendent of the Taylor Works at Buffalo. He will have charge of installation of electric interlocking in the Eastern territory, as well as of making estimates for the work. The habit of appointing, as agents, technically informed gentlemen who have a basis knowledge of the business they solicit is one to be encouraged, and no one appreciates it more keenly than the railroad officer who has business with them.

The Commonwealth Steel Company, St. Louis, was organized in Sept., 1902. During the past year the following orders have been booked: Separable body bolsters: Missouri Pacific, 5,300 cars; Denver & Rio Grande, 550 cars; Wabash, 1,500 cars; Mexican National, 500 cars; New York Central, 500 cars; Santa Fe, 1,200 cars; National Coal Car Dump Company, five cars. Special trucks: Chicago Great Western, 700 cars; St. Joseph & Grand Island, 250 cars; Interborough Rapid Transit Company, 350 cars; Lawson Dump Car Company, five cars. Standard truck and body bolsters: Chicago, Burlington & Quincy, 2,250 cars; Mexican Central, 1,100 cars; Atlantic Coast Line, 400 cars; Mexican National, 500 cars; Bellington & Beaver Creek, 300 cars; Union Pacific, 100 cars; Cold Blast Transportation Company, 100 cars; Cudahy Packing Company, 100 cars; Stewart-Peck Sand Company, 10 cars; Kansas City Refrigerator Car Company, 20 cars; New York Central, 250 cars; Missouri, Kansas & Texas, 1,100 cars; Chicago, Rock Island & Pacific, 10 tenders; Cincinnati, New Orleans & Texas Pacific, two tenders; Evansville & Terre Haute, 137 cars; Coal & Coke Company, 400 cars; Lehigh Coal & Coke Company, 20 cars.

Iron and Steel.

The Seattle Iron & Steel Company is planning to build an open hearth steel plant at Seattle, Wash.

The Richland Foundry Company, Belleville, Ill., it is reported, will build a new foundry. There will be two buildings—one 60 ft. x 150 ft., and one 30 ft. x 80 ft.

Press reports from Ottawa, Ont., state that the United States Steel Corporation proposes to establish an extensive plant in Ontario, probably at Port Burwell or Port Rowan.

The Racine Steel & Iron Mfg. Co., Racine, Wis., has increased its capital stock from $125,000 to $250,000. The additional funds will be used for enlargement and for new buildings.

A new company composed of Reading capitalists, reports say, is preparing to build a large iron mill at Millmont, Pa. The contract for the building has been awarded to G. W. Beard & Company.

The Eastern Steel Company, Philadelphia, Pa., is building a plant to cost about $3,000,000, and expects to start four open-hearth furnaces at a capacity of 100,000 tons per year in a few months.

The Consolidated Lake Superior Company, according to press reports from Sault Ste. Marie, Mich., will temporarily suspend operations in all the steel work at the company's rail mill, on the Canadian side of the river, until spring, as the close of navigation will make ore and coal too expensive.

The Fort Wayne Iron & Steel Company, Fort Wayne, Ind., has been incorporated with a capital stock of $175,000. The officers are: Edward F. Yarnelle, President, Fort Wayne; Walter I. Moody, Vice-President, Chicago; John W. Sale, Treasurer, Fort Wayne; Howell C. Rockhill, Secretary, Fort Wayne, and Chas. H. Rawlins, General Manager, Fort Wayne.

Grab-Irons on Locomotives and Tenders.

At the request of the Committee of the Master Mechanics' Association on this subject the application of grab-irons to locomotives and tenders in compliance with the ruling of the Interstate Commerce Commission, was discussed at some length at the September meeting of the Western Railway Club. Many believed that grab-irons tended to increase the number of accidents to employees as they presented additional temptations to board engines while in motion. The club adopted a resolution against the use of grab-irons on the front ends of locomotives.

Boiler Design.

The committee on boiler design of the American Railway Master Mechanics' Association held its first meeting in Chicago on Sept. 14. It was agreed that tests should be conducted which should disclose the temperature at selected points on the water side of the side sheets of locomotive boilers, and, also, at points in the water space near, but not in contact with the side sheet, all for boilers having wide grates and narrow grates, and for boilers having wide water legs and narrow water legs. It was determined, also, to extend the temperature observations to various points along the middle of the boiler shell between the rows of tubes and at various heights between the bottom and the top rows. The purpose of this investigation is to determine if possible the relation between the temperature of the plates and the failure of side sheets, and to settle beyond question the temperature of the water space close about the sheets. Obviously, if solid water were at all times in contact with the sheets, its temperature would be that of the steam in the boiler, but the claim has been made, and some evidence has been produced to sustain it, that both in the water leg of the boiler and between the tubes, the water is often so completely excluded as to give place to large bubbles or pockets of highly superheated steam, the presence of which permits the metal to become overheated.

The observations will be made by means of alloys fusing at known temperatures, and the work will be under the immediate charge of the chairman of the committee, Mr. David Van Alstyne, Superintendent of Motive Power of the Chicago Great Western.

A New Process for Electro-Deposition of Copper.

A new process has been developed for the electro-deposition of copper which enables the production at reasonable cost of copper forms of practically any design, weight or shape. In the usual process of electro-deposition a potential of 5 or 6 volts is used, and the resulting deposit, after the formation of the first thin layer, becomes granular. The new process gives a fine-grained homogeneous deposit of any thickness desired and of great ductility and tensile strength according to a test reported made at the Columbia School of Mines, which places the tensile strength at 34,500 lbs. This is higher than for ordinary rolled copper. The value of the new process lies in the use of a low-voltage current, obtained by passing an ordinary lighting current through a transformer of special and secret design. It yields a current having a potential of $^{6}/_{10}$ of a volt, and giving a deposit of 1 lb. of copper per 381 ampere-hours; or stated another way, a layer of $^{1}/_{16}$ in. will be deposited in about one week's time.

One application already made of the process is for the production of bent or coiled seamless copper pipe of varying diameters, ready-formed. Bending copper pipe in any but the smallest sizes is a laborious and expensive process, and the difficulty increases with the diameter. The seams also give trouble. In the electro-deposition process a lead-pipe mold, the outside diameter of which is the inside diameter of the copper pipe to be made, is bent to the desired shape and placed in the bath. After the desired thickness of deposit has been obtained the lead mold is melted out of the copper pipe.

The variety of forms that it is possible to produce in copper by the process is only limited by the designs of molds that can be prepared of a conducting and easily feasible or removable material. Wooden surfaces can be prepared to give them a copper sheathing. Some sample forms produced by the process include a small boat formed on a wooden mold, and a small copper burial casket.

The process is owned by the Seamless Copper Process Manufacturing Company, Whitehall Bldg., New York. The company has a small plant in operation and arrangements are under way for a more extensive plant.

A Timber Testing Station at Purdue University.

The Bureau of Forestry, United States Department of Agriculture, has begun an investigation of the mechanical properties of the commercial timbers of the United States, and has established a timber testing station at Purdue University, LaFayette, Indiana, to form the nucleus of the work in the Mississippi Valley region. Other stations have been established at the University of California, at the Yale Forest School, and at Washington, D. C. Physical and mechanical tests will be made according to uniform methods at these stations by experts of the Bureau of Forestry. This action of the Bureau does not involve the erection of additional buildings but a more thorough utilization of equipment already existing in the Purdue Laboratory for Testing Materials. Additional machines of a special character, however, belonging to the Bureau, will be installed in the laboratory for the needs of this work. The work of this station will be under the direction of Dr. W. K. Hatt, who has recently been appointed to have supervisory charge of the work of all the timber testing stations of the Bureau of Forestry. Responsibilities thus assumed by Dr. Hatt will not interfere with the discharge of his duties at Purdue University.

The university has for many years given a large amount of attention to the investigation of materials of construction. The results of the tests on cements and steel concrete are used by engineers at home and abroad, and the experiments on iron and steel under impact are the most extensive of their kind. Considerable work has been accomplished in an investigation of the strength of nailed wooden joints, and, during the last year, an interesting study on hickory was begun. The botanical department of the University has also contributed original knowledge to the microscopic structure of woods. The selection of the Purdue laboratory is, no doubt, also due to the reputation which Purdue has already established for its work in handling in an efficient way large pieces of commercial testing. The fact that some years ago the engineering laboratory of Purdue University was made the official laboratory of the Master Car Builders' Association and has received from that association more than $10,000 worth of equipment speaks well for the character of the work it is doing. The University is thus in a position to handle this new work in timber investigation, and mutual benefit will result from this co-operation between the Bureau of Forestry and Purdue University.

The immediate work of the Bureau of Forestry at the

Purdue station will be a study of the red gum, a wood that is of very widespread growth, and, although possessing valuable properties, is at present largely neglected through prejudice. . An investigation will also be made of the strength of packing boxes with a view to standardizing and determining the necessary thickness of box boards in which at present there is such large waste of material. The character of these investigations is in harmony with the work of the Bureau of Forestry which through prejudice. An investigation will also be made gained the support and sympathy of the lumbermen and of consumers of timber.

THE SCRAP HEAP.

Notes.

The Michigan Central has secured a favorable decision in the United States Circuit Court in its suit to recover $6,838 for war revenue stamp taxes unlawfully exacted from the road on duplicate bills of lading. The case will be appealed.

Michael Schriver, a yard brakeman of the Pennsylvania at Crestline, Ohio, is the proud owner of a fine gold watch presented to him by the company for prompt action in saving the Pennsylvania Limited, eastbound, from being wrecked at that place recently.

The prosecutions carried on by the Railway Protective Bureau against the ticket scalpers have resulted, at Buffalo, in the arrest of three men and the capture of a lot of rubber type, punches, ink, acids and other things used in altering tickets. The *New York Commercial* prints a long list of tickets and passes captured, with names and dates.

Vice-President C. S. Sargeant, of the Boston Elevated Railway, has notified the employees of the road that the legal department of the company will, at any time, furnish legal advice free to the employees concerning their personal affairs. This undertaking is an experiment and the privilege may be enlarged or qualified or discontinued, if it should be found necessary to do so.

Some of the manufacturers of Chattanooga, Tenn., who have been inquiring, through their Chamber of Commerce, concerning freight rates to California, claim that by reason of a recent increase in rates they will lose $279 a day. They find that during the 12 months ending on the first of last month 2,116 cars of freight were shipped from that city to places on the Pacific slope.

Press despatches of September 21 say that on the Boston & Northern street railroad large numbers of counterfeit transfer tickets have been discovered, and that a large number of conductors have been guilty of defrauding the company by their use. The police have discovered five plates which have been used at different places in printing the tickets. Five men have been arrested.

At Baltimore this week the Western Maryland took further proceedings in the courts to prevent the Baltimore & Ohio from backing out of an alleged contract to send certain freight traffic over the W. M. bound for the Philadelphia & Reading. Since the W. M. passed into the hands of the Wabash (Gould) interests, certain freight has been diverted to the Cumberland Valley.

Passengers who have traveled over the Albany & Hudson (electric) railroad have complained to the New York State Railroad Commissioners because the company charges 25 cents for carrying a trunk and a satchel in the baggage compartment of the car. At a hearing held by the commissioners, an officer of the road said that they had found that when baggage was carried free, the passengers not only covered several seats with their luggage but also carried beef and farm produce.

Keep Your Currents in Leash.

The Electrical Engineer of the District of Columbia in his annual report asks for an appropriation of $5,000 for a thorough investigation of the subject of electrolysis of water mains and other metallic sub-surface work in the District of Columbia.

Further Speed Trials in Germany.

Press despatches of September 21 report that the experiments with electric motors on the Berlin & Zossen military railroad are being continued, and that on the 19th of September a rate of 114 miles an hour was attained. One account says that this rate was maintained for two miles. The whole of the 18 miles of line over which the experiments are made is guarded by soldiers, so that the public cannot take notes.

Cost of the Paris Disaster.

According to *Transport*, the recent disaster on the Paris Metropolitan will cost that company about $1,750,000, in which compensation claims will figure for about $388,000. The municipality of Paris has called on the company to provide an improved system of electric traction, to put in air shafts, to use incombustible cars and to arrange for independent lighting of stations. The requirements of the municipal authorities apply not only to the section now in operation, but also to the other sections which are building.

Attendance at Purdue University.

At Purdue University, La Fayette, Indiana, the increase in the three engineering courses last year was 212, or 27 per cent. Notwithstanding the higher entrance requirements, designed to curtail the attendance, the enrollment for the school year just opening, is already such as to indicate a larger percentage of increase for the present year than for any previous year. The total number of engineering students enrolled last year was 998, divided as follows: Civil engineering, 265; mechanical engineering, 361; electrical engineering, 372. The total attendance by classes was: Freshmen, 334; sophomores, 298; juniors, 218; seniors, 118; post-graduates, 30.

Fires.

A fire in San Francisco, on the night of the 12th, caused a damage of about $200,000 to the Southern Pacific in which its warehouse and a number of freight cars were destroyed. At Elizabeth City, N. C., a fire on the 16th destroyed a steamer, also the Norfolk & Southern freight house, including a large amount of freight, at a loss of about $100,000. On the 17th the transformer house of the Snoqualmie Power Company at Snoqualmie, Wash., was burned, causing the shutting off of all power in the city from the street lines, and in Seattle and Tacoma from the Seattle & Tacoma Interurban and the Seattle & Fenton railways. The lights in Fenton and Tacoma were also shut off. A fire on the 19th at the power house of the Union Street Railway Company, New Rochelle, N. Y., completely destroyed the plant and all the lines in and near New Rochelle were stopped for three or four days.

Breakdowns in Tunnels.

There was a breakdown of a train in the Central London railway tunnel—"the 'Tuppeny Tube"—on the night of September 8, and, according to *Transport*, the occurrence was a fortunate one, in that it served to test the arrangements which have been made for the safety of passengers in such contingencies, and to show that panics do not necessarily follow every slight disturbance on a tunnel railroad. The car was derailed at a cross-over, creating a short circuit, and the lights were extinguished; but there were oil lamps, so that the darkness was not complete, and in a few minutes the emergency electric lights in the tunnel were turned on. The passengers were not electrocuted in getting out, and everything worked smoothly. The Paris accident has aroused public officials in every city which has underground railroads, and a commission appointed by the Minister of Public Works has made a report concerning conditions on the Berlin lines. The recommendations are similar to those made in Paris and elsewhere: an independent lighting current, arrangements for quickly cutting out sections of the power current, and the best possible means of exit for passengers.

Motor Cars as Feeders in England.

Herapath's Railway Journal says that the Great Western of England will establish motor car services as feeders to the railroad in country districts. The vehicles will furnish links between the railroad stations and outlying villages and small towns in different parts of the country which need improved traveling facilities. The competition of electric lines seems to have been a moving factor in the decision. The place selected for the commencement of the experiment is the line between Stonehouse and Chalford in the Stroud Valley, a distance of seven miles, where cars will be used capable of carrying 52 passengers. They will be propelled by steam power and will make four stops in addition to the ordinary railroad stations at Stroud and Brimscombe. Several motor vehicles will also be run upon the highways to meet tramway competition and to develop localities at present without railroad facilities. A service of this sort was inaugurated between Helston and Lizard Point, in Cornwall, in August. In this country there have been a number of similar experiments tried but in no case has the service been extended beyond one or two experimental cars. It has not been found profitable to compete with the electric roads along this line.

MEETINGS AND ANNOUNCEMENTS.

(For dates of conventions and regular mettings of railroad associations and engineering societies see advertising page xvi.)

The Roadmasters' & Maintenance of Way Association.

The next annual convention of this Association will be held at Kansas City, Mo., Oct. 13 to 15. The Coates House will be the headquarters for the members while in the city. Reports of committees will be made on the following subjects: Maintaining Line Surface and Gage, Educating Young Men to Make Foremen of Them, and Discipline of Section Men, New and Improved Appliances, Track Drainage and Tiling, Ties and Tie Plates and Preservation of Ties, and Machine Ditching. Papers will be presented in addition on the following subjects: Use of Sixty-foot Rails to Avoid Joints in Crossings, by J. A. Lahey, Chicago Terminal Transfer; General Track Work, by A. Morrison, Cambria Steel Company; Timber Preservation, by Dr. Hermann von Schrenk; Track Tools, by J. C. Rockhold, Santa Fe; Creeping of Rails, by F. J. Allen, Chicago, Burlington & Quincy. The Road & Track Supply Association will attend to exhibits. Chas. McEniry, Secretary, Sedalia, Mo.

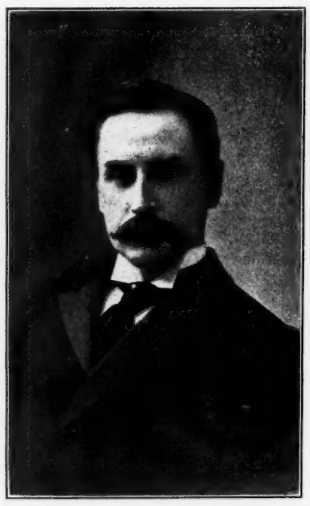
American Association of General Passenger and Ticket Agents.

The next annual meeting of this association will be held at Hotel St. Charles, New Orleans, Oct. 13. A report on Anti-Scalping Legislation is to be presented by General Passenger Agent Daniels of the New York Central; and one on the use of safety paper by Messrs. Nicholson, of the Santa Fe, and Eustis, of the Burlington. A resolution of the Association of American Railway Accounting Officers will also be considered which provides for the printing of the name of the railroad over which the coupon of interline tickets is good, so that it will attract the attention of the conductor to whom it is presented. Other subjects to be presented are: Uniformity in the regulations regarding stop-overs on limited tickets, including excursion tickets at authorized points, to determine whether stop-over is to be allowed on return trip at authorized points on excursion tickets for ten days, within the final limit of the excursions, irrespective of the return transit limit; Uniformity in charges for transfer service; Uniformity in dealing with tickets lost by passengers, to be bulletined on merits of case. The orator for this year is W. J. Lynch, of the Cleveland, Cincinnati, Chicago & St. Louis.

PERSONAL.

—Mr. L. H. Ackert, Trainmaster of the Southern Railway at Columbia and brother of Mr. C. H. Ackert, General Manager of the company, died Sept. 22. Mr. Ackert's death followed an accident at Greenville, Miss., in which he was struck by a train.

—Mr. Percy R. Todd, who is soon to become First Vice-President of the New York, New Haven & Hartford, is about 44 years old. He was born in Toronto, Ont., and was educated at the Collegiate Institute at Ottawa. His early railroad experience was on the St. Lawrence & Ottawa (Canadian Pacific) as clerk and telegraph operator. He was later with the Ogdensburg & Lake Champlain for seven years, then for three years he was in Chicago with the National Despatch Line. In 1886 he was appointed General Freight and Passenger Agent of the Canada Atlantic. In 1889 he became General Freight Agent of the West Shore, and three years afterwards Traffic Manager. He resigned from this road in 1901 to become Second Vice-President of the New York, New Haven & Hartford, from which position he is now promoted to the First Vice-Presidency, succeeding Mr. Merrill.



—We announced last week that Mr. J. M. Hall, President of the New Haven road, would soon retire. At a meeting held on Tuesday of this week the Board of Directors of the company adopted a resolution recommending the appointment of Mr. Hall as General Counsel for the company.

—Colonel J. H. Underwood of Portland, Or., died at his home in that city on Sept. 21. Col. Underwood was a prominent railroad builder of the northwest, having built portions of the Northern Pacific, the Canadian Pacific and the Great Northern. He did some of the most difficult work on the pioneer lines. He was a member of the Minnesota Legislature almost continuously for 22 years.

—Mr. Charles Sanger Mellen, President of the Northern Pacific, who about November 1, will go to the New York, New Haven & Hartford, to succeed Mr. Hall as President, left the Vice-Presidency of the New Haven company in 1897 to become President of the Northern Pacific. Mr. Mellen is a native of Massachusetts, having been born in Lowell in 1851. He has been in railroad service about 35 years, beginning as a clerk in the Cashier's office of the Northern New Hampshire. He continued in minor positions with this company and the Central Vermont, until 1880, when he was made Assistant to the Manager of the Boston & Lowell, later becoming Auditor and Superintendent of the road, and, in 1884, General Superintendent. Four years later he went to the Union Pacific as General Purchasing Agent, and remained with that company until 1892, after being promoted to the position of General Traffic Manager. He then became General Manager of the New York & New England at Boston. In 1892 Mr. Mellen went to the New York, New Haven & Hartford, and for about five years before going to the Northern Pacific in 1897 he was Second Vice-President of the New Haven road.

—Mr. H. D. Hartley has been appointed laboratory assistant at the Timber Testing Station of the Bureau of Forestry which has been established at Purdue University, Lafayette, Indiana. Mr. Hartley is a graduate of Purdue University in Mechanical Engineering, class of 1903. He has had extensive experience in the business of

manufacturing vehicles, and has studied extensively the mechanical properties of the different grades of merchantable second growth hickory.

—Mr. A. W. Baker, the new Assistant Superintendent of the Western Division of the Southern Pacific at Oakland Pier, Cal., began his railroad service with this company in 1879. From then until 1884 he was employed as a telegraph operator and relief agent at various places. In 1886 he was made chief clerk to the Resident Engineer of the Western Division, and in 1894 he was made Chief Accountant. From 1898 until his present appointment, Mr. Baker was chief clerk in the offices of the Superintendent and Resident Engineer at Oakland Pier.

—Mr. A. C. Hone, who has succeeded C. M. Browning as General Manager of the Louisville & Atlantic, was formerly Master Mechanic of the Cumberland Valley Division of the Louisville & Nashville. Mr. Hone began his railroad career as Assistant Engineer in the Maintenance of Way department on the Evansville & Terre Haute in 1898, and was promoted to be Superintendent of Motive Power in 1899. In 1901 he was appointed Superintendent. The next year (1902) Mr. Hone resigned and went to Louisville, to become Assistant Master Mechanic on the Louisville & Nashville and a few months later was promoted to the position he now leaves, that of Master Mechanic.

ELECTIONS AND APPOINTMENTS.

Canadian Pacific.—O. O. Winter, formerly Assistant General Superintendent of the Great Northern, has been appointed Superintendent of Terminals of the C. P., with headquarters at Winnipeg, Man.

Galveston, Harrisburg & San Antonio.—Percy Hewett has been appointed Superintendent of Telegraph, with headquarters at Houston, Texas.

Great Northern.—J. R. W. Davis, heretofore Engineer of Maintenance of Way of the Erie, has been appointed Engineer of Maintenance of Way of the G. N.

Louisville & Atlantic.—H. L. Mosier has been appointed Auditor, with headquarters at Versailles, Ky., succeeding V. M. Nourse.

Louisiana & Arkansas.—J. H. Conlin has been appointed Superintendent, with headquarters at Stamps, Ark.

Montana.—F. T. Robertson, Superintendent and Chief Engineer, with headquarters at Lombard, Mont., has resigned from the former position.

Macon & Birmingham.—J. A. Streyer has been appointed General Freight and Passenger Agent.

New York, New Haven & Hartford.—At a meeting of the Directors held recently, R. A. McCurdy and Charles S. Mellen were elected Directors, succeeding the late Joseph Park and Carlos French, respectively.

Pennsylvania.—S. S. Blair, Superintendent of the Tyrone Division, with headquarters at Tyrone, Pa., has resigned.

Philadelphia & Reading.—C. E. Henderson, Second Vice-President of this company, has been elected First Vice-President of the Philadelphia & Reading Coal & Iron Company; R. C. Luther has been elected Second Vice-President, and W. J. Richards becomes General Manager of the coal company.

St. Louis, Memphis & Southeastern.—W. R. Powe has been appointed General Freight and Passenger Agent, with headquarters at St. Louis, Mo. succeeding E. F. Blomeyer, resigned. It is understood that Mr. Blomeyer has taken a position with the Pere Marquette.

Southern.—W. S. Andrews, heretofore Assistant Superintendent of the Danville Division, has been appointed Superintendent of the Washington Division, with headquarters at Alexandria, Va., succeeding W. G. Choate, resigned.

J. A. White has been appointed Assistant Superintendent, with jurisdiction over the Harrisonburg and Bluemont branches, with headquarters at Alexandria, Va.

LOCOMOTIVE BUILDING.

The Mississippi River & Bonne Terre is having three locomotives built at the Richmond Works of the American Locomotive Company.

The New York Central & Hudson River is having five locomotives built at the Schenectady Works of the American Locomotive Company, in addition to the seven already reported in our issue of July 24.

The Mobile, Jackson & Kansas City, as reported in our issue of Sept. 11, has ordered eight 10-wheel (4-6-0) and two eight-wheel (4-4-0) locomotives from the Baldwin Locomotive Works, for November delivery. The 10-wheel locomotives will weigh 140,000 lbs., with 111,000 lbs. on the drivers; cylinders, 19 x 24 in.; diameter of drivers, 56 in.; working steam pressure, 200 lbs.; 291 Tyler tubes, 2 in. in diameter and 13 ft. long; fire-box, 108 1/16 in. long and 33 1/8 in. wide; tank capacity, 5,000 gal. Special equipment includes: Westinghouse air-brakes. The eight-wheel locomotives will weigh 113,000 lbs., with 70,000 lbs. on the drivers; cylinders, 18 x 24 in.; diameter of drivers, 68 in.; diameter of boiler, 56 in.; working steam pressure, 180 lbs.; 246 Tyler tubes, 2 in. in diameter and 12 ft. 1/4 in. long; fire-box, 78 1/16 in. long and 34 3/8 in. wide; tank capacity, 4,500 gal.

CAR BUILDING.

The Louisville & Nashville is reported in the market for 1,500 cars.

The Atlantic Coast Line has ordered six coaches from the Pullman Co.

The Pere Marquette is reported to be figuring on some new passenger equipment.

The Chicago Union Traction has ordered 100 cars from the St. Louis Car Company.

The White Pass & Yukon is about to build several passenger cars at its own shops.

The Chesapeake & Ohio has ordered 1,000 steel cars from the Pressed Steel Car Co.

The Southern Iron Car Line is having 100 freights built by the Georgia Car & Mfg. Co.

The Fayette Coal Company has ordered 100 coal cars from the American Car & Foundry Company.

Crerar, Clinch & Co., Chicago, have ordered 58 coal cars of 100,000 lbs. capacity from the Pullman Company.

The Delaware, Lackawanna & Western is having 20 coaches built by the Wason Mfg. Co., Springfield, Mass.

The Detroit Southern is having 325 freights built at the Detroit Works of the American Car & Foundry Company.

The National Refining Company, Cleveland, Ohio, has ordered 30 tank cars from the American Car & Foundry Company.

The Maryland & Pennsylvania denies that it is having any freight cars built at the South Baltimore Car Works at the present time.

Christie, Lowe & Heyworth, Chicago, have ordered two narrow gage locomotives—one to be built by H. K. Porter & Co., and the other by the Vulcan Iron Works, Wilkesbarre, Pa.

The Chicago Great Western has ordered 11 coaches, five milk cars and four chair cars from the Pullman Company, in addition to the 16 cars recently ordered from the same company.

The Michigan Central is in the market for 10 coaches, 69 ft. long over end sills, 10 ft. wide and 14 ft. 6 in. high. Special equipment will include Diamond brake-beams, National-Fulton brasses, Gould couplers, Gould pendulum vestibules, Gould journal box and journal box lids, Forsyth curtain fixtures, Pantasote curtain material, Westinghouse friction draft rigging, Harrison dust guards, Pintsch gas and Standard steel platforms.

The Chicago, Lake Shore & Eastern, as reported in our issue of Sept. 18, has ordered 15 steel coke cars of 100,000 lbs. capacity, from the American Car & Foundry Company. These cars are to be 40 ft. long. Special equipment includes Simplex bolsters and brake-beams, Westinghouse brakes, Buckeye couplers, Miner drawbar attachments, Barber trucks, McCord journal boxes, Railway Steel Spring Co.'s springs, and National-Fulton Brass Mfg. Co.'s journal bearings.

The Chicago & Eastern Illinois, as reported in our issue of Sept. 18, has ordered 500 flat bottom gondolas of 100,000 lbs. capacity from the Western Steel Car & Foundry Company, and 400 box cars and 100 side dump cars of 80,000 lbs. capacity from the American Car & Foundry Company for October and November delivery. The gondolas are to be equipped with American steel truck bolsters and column castings, Chicago couplers, Damascus brake-beams and Miner drawbar attachments. The special equipment for box cars includes American Steel Foundries transom and truck bolsters, Chicago couplers, Miner drawbar attachments, Damascus brake-beams and Hutchins inside metal roofs.

BRIDGE BUILDING.

ANDERSON, S. C.—The County Commissioners may build a new iron bridge over Seneca River, at a point near the tree ferry, to cost about $7,000.

BENTONVILLE, ARK.—A bridge may soon be built by the county over White River near Van Winkle ferry at a cost of about $20,000.

BOWMANSTOWN, PA.—The Penn Erecting Company is estimating the cost of a three-span steel bridge to be built in Carbon County.

BROOKLYN, N. Y.—The Brooklyn League is urging the Board of Estimate and Apportionment for a bond issue of $75,000 to pay for a new bridge over the Gowanus Canal at Union street.

CAMDEN, N. J.—Bids are wanted Oct. 14, by the Board of Chosen Freeholders, for a bridge over Cooper's Creek at Stey's Landing. Fred. W. George, Clerk.

CANNON FALLS, MINN.—The Chicago Great Western will, it is reported, build a steel bridge over Big Cannon River to replace the present wooden structure.

CHATTANOOGA, TENN.—The building of a bridge over the Tennessee river at a cost of about $450,000 is being agitated by the business men at this place. Plans are being prepared by T. R. Postlewaite, civil engineer and surveyor, which call for a structure of three spans of 311 ft. each, 132 ft. high from the bed of the river, with approaches of 1,200 ft. The Chattanooga Trust Company and others are interested.

CLINTON, IND.—The Chicago & Eastern Illinois, press reports state, will build a second bridge over the Wabash River at Clinton, on which work is to be commenced shortly.

COATZACOALCOS, MEXICO.—Harry Givler has the contract for building a large bridge over the Tula River on the National Tehuantepec Railroad.

CORYDON, IND.—Bids are wanted Sept. 26 by the Board of County Commissioners for building steel piers and some concrete bridge work in Posey Township.

FLUSHING, N. Y.—The Bridge Department has plans completed and will ask bids for the new bridge over Flushing Creek, at the foot of Broadway, as soon as the Mayor signs the ordinance appropriating $325,000 for this work. It is believed that the Mayor will sign the ordinance, as he voted for it in the Board of Estimate and Apportionment.

FORT DODGE, IOWA.—Plans are being prepared for a viaduct at North Fifteenth street, 600 ft. long with 30-ft. roadway. C. H. Reynolds, City Engineer.

HARRISBURG, PA.—Plans, it is reported, are being prepared for the building of a bridge over Broadhead Creek in Monroe County, at a cost of $60,000; also for a bridge over Shamokin Creek in Northumberland County, to cost $12,000.

HOUSTON, TEXAS.—Bee County has voted to issue bonds to rebuild the bridges damaged and destroyed by floods and storms.

MARSHALLTOWN, IOWA.—Plans have been made for a 1,200-ft. highway bridge over the railroad tracks at Center street, to cost about $40,000.

MEADVILLE, MISS.—The Board of Supervisors has adopted plans and specifications for the building of four steel bridges in the county, two over Homochitto River, one at Wrightsford, and one at Holloway Bluffs, at a total cost of $31,000. C. A. Pritchard, Chancery Clerk.

MONROE, LA.—The Police Jury has appropriated $17,500 for roads and bridges.

MUNCIE, IND.—Delaware County Commissioners have made an appropriation of $100,000 for improvements, which include a number of bridges.

NEWARK, N. J.—Plans in the hands of County Engineer Owen call for a bridge over the Hackensack River, on the line of the "plank road," at a cost of about $450,000, to be built jointly by Essex and Hudson Counties.

NEWARK, OHIO.—Bids are wanted Oct. 5 by A. R. Pitser, Licking County Auditor, for the substructure and superstructure of the Knisely bridge, to be built on the line between Union and Harrison townships.

NEW CASTLE, PA.—The residents of Pulaski township have presented a petition for a bridge over Deer Creek. H. E. Bleakley is interested.

OMAHA, NEB.—The Union Pacific, local reports say, has petitioned the Council Committee to pass an ordinance authorizing work on its viaduct at Eighth and Davenport streets, to commence early in December.

OTTAWA, ILL.—The county may soon build a bridge over Vermilion River, at a cost of $10,250, at Sandy Ford.

PERU, IND.—The County Council, local reports say, will soon make an appropriation of $45,000 for the building of a new bridge at the east end of the city. C. W. Macy, County Auditor.

PITTSBURG, PA.—The Pennsylvania, local reports say, has plans ready for a second bridge from the new stock yards on Herr's Island, to cost about $150,000 and to be 400 ft. long, with channel span of 240 ft.

PORTLAND, ORE.—It is reported that the city may soon ask bids for the steel bridge over Sullivan Gulch on Grand avenue, to cost about $75,000. W. C. Elliott, City Engineer.

PUEBLO, COLO.—Bids are wanted Oct. 10 by L. G. Carpenter, State Engineer, Denver, Colo., for the building of a highway bridge not less than 300 ft. long in one or two spans, to be all steel or combination, over the Arkansas River near this place.

RACINE, WIS.—Plans are being prepared which provide for rebuilding the State bridge at a cost of about $12,000. P. H. Connolly, City Engineer.

RICHMOND, VA.—Viewers have been appointed to select a site for a bridge over Chipoax Creek, between Surrey and Prince George Counties.

SPRINGFIELD, OHIO.—The plans prepared by City Engineer Sieverling for the bridge across Buck Creek, at Snyder Park, call for a concrete structure to cost $16,000, or a steel bridge to cost about $23,000. The total length will be about 130 ft.

TAMPICO, MEXICO.—A bridge is being built by the Mexican Central over the Grand Canal on the Panuco division of the road. The structure is to be a 20 meter span with the track placed 16 meters above the bottom of the canal.

WEISER, IDAHO.—Contract, it is reported, has been let to the American Bridge Company of New York, for the bridge to be built at this place. This company's bid for the bridge and approaches was $31,595 and $1,200. Other bids were: The Northwestern Bridge Company, $34,050 and $1,150; the J. W. Wood Company, $33,300 and $1,094; the Minneapolis Bridge Company, $32,300 and $1,700.

WENATCHEE, WASH.—The County Commissioners have awarded to the Puget Sound Bridge & Dredging Co. the contract to build a steel bridge over the Wenatchee River; cost $13,980, and $520 for approaches.

WHEELING, W. VA.—The Baltimore & Ohio bridge between this place and Barton is to be rebuilt with an additional track, and a number of other bridges for the B. & O. will have the same improvements made to them.

WILLIAMSPORT, IND.—The County Council, reports say, has appropriated $95,000 for building a bridge over the Wabash River near this place; also for one over the same river at Independence.

Other Structures.

AGUAS CALIENTES, MEXICO.—The Mexican Central is building a large foundry at this place. Machinery is being installed in the new shop buildings of the company. An electric apparatus is to be installed at its tie-treating plant which was recently established here.

ANDERSON, IND.—The Indiana Union Traction Company, it is reported, is receiving bids for the building of car shops at Anderson, in which the company intends to build and repair its own cars. The buildings will cover about six acres of ground and cost $300,000.

BIRMINGHAM, ALA.—The Southern Railway, local reports state, will build a passenger station and office building.

BRANTFORD, ONT.—The Grand Trunk has reached an agreement with the city council regarding improvements, which include the building of a station to cost about $30,000 and two subways.

CHATHAM, ONT.—The Lake Erie & Detroit River Railway purposes making extensive improvements at Erieau, including the building of a large coal hoist, the extension of the present dock and the dredging of the channel.

CHICAGO, ILL.—The Chicago & North Western, local reports say, has completed arrangements for a new office building at Jackson Boulevard and Franklin street. The land already bought by the railroad at this site cost nearly $400,000.

COATZACOALCOS, MEXICO.—D. E. Keating has a contract from the National Tehuantepec for a number of new buildings.

DURHAM, N. C.—The State Corporation Commission issued an order for the building of a joint station by the Southern, Seaboard Air Line and Norfolk & Western roads.

HONEY STATION, MEXICO.—A handsome stone station is being built at this place, also one at Telles by the Mexican Central.

MADISON, WIS.—The Northwestern will, local reports say, build a new passenger station which will occupy the entire block between Blount and Livingston streets.

MOBILE, ALA.—A union passenger station may soon be built at this place. Reports say ground has already been bought. (Sept. 18, p. 680.)

NASHVILLE, TENN.—The Tennessee Central, according to local reports, will build a freight and passenger station at Cedar street in West Nashville.

NEWPORT BEACH, CAL.—The Southern Pacific, reports say, will build a wharf 3,000 ft. long, with three tracks abreast, to cost about $15,000, at Newport Beach.

NEW YORK, N. Y.—The Pennsylvania will, in the early part of next month, ask bids for the building of the tunnels from New Jersey to New York under the North River, also from New York to Long Island City under the East River, including all the work but the stations.

OELWEIN, IOWA.—A contract, it is reported, has been awarded to W. J. Zitterell, of this city, by the Chicago Great Western, to build its 40-stall roundhouse in Oelwein at a cost of $63,000.

QUERETARO, MEXICO.—A handsome new stone station will be built here by the National of Mexico.

ROME, GA.—The Southern Ry. will soon commence work on the new passenger station at East Rome, to cost about $25,000.

SPARTANBURG, S. C.—The railroads at this place, local reports say, will jointly build a station to cost about $25,000.

RAILROAD CONSTRUCTION.

New Incorporations, Surveys, Etc.

ATCHISON, TOPEKA & SANTA FE.—An officer says that work will shortly be resumed on the proposed cut-off from Dodge City, Kan., to Belen, N. Mex. Langtry & Co. have the contract for grading. No reason has been given for the temporary abandonment of the work.

BIRMINGHAM & STEEL CITIES R. R.—Contract for building this electric railroad has been let to Knox, George & Co., New Orleans, La. The proposed route is from Birmingham, Ala., through Ensley, Pratt City and Bessemer, a total distance of 41 miles. Surveys will be begun at once and grading will probably be started before the end of the year.

CANANEA, YAQUI RIVER & PACIFIC.—It is reported that the concession from the Mexican Government owned by this company has been purchased by the Southern Pacific. The concession grants the right to build a railroad from Naco, on the border of Arizona, to Cananea, and thence in a southerly direction to the mouth of the Yaqui River, and to Matanzas. It is stated that work will be begun at once. (April 17, p. 289.)

CASPAR, SOUTH FORK & EASTERN.—An officer writes that surveys have been completed for about 15 miles on this proposed road from Caspar, Cal., east to Willits, Mendocino County, 35 miles. Rights of way have been secured and surveys for the remainder of the line will be made at once. Contracts for grading will be let in the early spring. R. E. Andrews, Caspar, Cal., is Chief Engineer, and H. E. Krebs, San Francisco, is President. (Aug. 21, p. 610.)

CHICAGO, BURLINGTON & QUINCY.—The cut-off from Tracy, Iowa, east to Oskaloosa, 12 miles, has been completed and will soon be placed in operation. The new line connects the Des Moines-Albia division with the Burlington & Western division. (April 3, p. 255.)

CHICAGO, MILWAUKEE & ST. PAUL.—The annual report of this company says that the following lines were finished during the past year: Ashdale, Ill., to Ebner, 15 miles; Muscatine, Iowa, to Rutledge, 76 miles; Eureka, S. Dak., to Linton, N. Dak., 49 miles. Reductions of grades were made on the River Division between La Crosse and St. Paul, and on the Iowa & Minnesota Division between Austin and Rosemont. Lines are now building from Zumbrota to Faribault, Minn., 35 miles; from Preston to Isinours, Minn., four miles; from Le Sueur Center to Mankato, 20 miles, and from Woonsocket to Wessington, S. Dak., 16 miles.

CINCINNATI, NEW ORLEANS & TEXAS PACIFIC.—The newspapers say that a second track will shortly be built from Ludlow, Ky., south to Lexington, 75 miles. The improvement is made necessary by the heavy increase in freight traffic.

CUBAN ROADS.—It is reported that a new railroad will be built from Jaguney to Cantello, for the purpose of carrying grain and fruit to Yumuri, where connection will be made with a line of steamers to the United States.

It is stated that the board of directors of the Cardenas & Jucaro have completed plans for building an extension from the present southern terminus at Yaguaramas to Cienfuegos. It is expected that work will be begun soon.

DELPHOS & NORTHERN.—See Cincinnati, Hamilton & Dayton under Railroad News.

DENVER & RIO GRANDE.—The newspapers say that this company is planning to build two cut-offs, one from Littleton, Colo., to Sedalia, 12 miles, and one from Castle Rock to Monument, 20 miles, in order to shorten the line and lessen the grades on its main line from Denver to Colorado Springs.

DENVER, ENID & GULF.—An officer is reported as saying that this company is contemplating the extension of its line from Enid, Okla. T., northwest to Hays, Kan., 170 miles. Connection will be made with the Union Pacific at Hays. E. L. Peckham, Enid, is Vice-President and General Manager. (Aug. 28, p. 624.)

DIXON, ROCK FALLS & SOUTHWESTERN (ELECTRIC).—Contract has been let to Robert Gregory, New York, for building this electric railroad from Dixon, Ill., through Rock Falls, Tampico, Atkinson and Geneseo to Rock Island. H. L. Sheldon and O. E. Maxson, of Dixon, are interested.

FORT SMITH & WESTERN.—The newspapers say that this road, building from Fort Smith, Ark., to Guthrie, Okla. T., 217 miles, has been completed and placed in operation. M. T. Herrick, H. C. Frick, M. A. Hanna and others are among the promoters.

LAKE ERIE & PITTSBURG.—The contract for building this line from Lorain, Ohio, southeast to Youngstown, 85 miles, has been let to Kenefick & Co., Pittsburg, Pa. The new line will pass through Lorain, Summit, Geauga, Portage and other counties. Work will probably be begun at once. W. B. Thompson, P. J. Robinson, C. L. Penny and others of Columbus, Ohio, are said to be interested. (May 15, p. 352.)

MEXICAN CENTRAL.—The Mexican Government has granted a concession to this company for building and operating a branch line from San Pedro, in the State of Coahuila, north to the coal fields of Las Esperanzas. The coal and coke furnaces of Las Esperanzas are operated by the Mexican Coal & Coke Company.

It is reported that the Mexican Central will begin work immediately on its cut-off from Salamanca, in the State of Guanajuato, north to Guanajuato, 25 miles.

MEXICAN ROADS.—Press reports state that a railroad will shortly be built between El Oro and Thalpujahua, 10 miles. P. Meyer, Mexico City, is said to be interested.

MINNEAPOLIS, ST. PAUL & SAULT STE MARIE.—The annual report of this company for the fiscal year ending June 30, states that the mileage has been increased during the year by the completion of the line from Braddock, N. Dak., to Bismarck, 41 miles. The branch which is being built from Glenwood, Minn., north into the White Earth Indian reservation, and the extension from Birchwood, Wis., north to Reserve, when completed, will add about one-tenth to the present mileage.

MISSOURI, KANSAS & TEXAS.—Press reports state that work has been begun relaying the main line from South McAlester, Ind. T., to Denison with 80-lb. rails, in place of the 60-lb. rails now in use.

Press reports state that the branch line of this company running from Colmesnil, Texas, to Trinity, will shortly be extended southwest to Smithville, 150 miles. Connection will be made with the main line at Smithville.

MISSOURI PACIFIC.—An officer writes that no surveys are now being made from Joplin, Mo., west to Chetopa, Kan., as stated in current press reports.

NEVADA ROADS.—It is reported that the Tonopah Mining Company will build a railroad from Sodaville, Nev., on the Southern Pacific, east to Tonopah, in Esmeralda County.

NORFOLK & WESTERN.—The annual report of this company for the year ending June 30, makes the following statement with regard to construction work. The low-grade line from Naugatuck to Kenova, 59 miles, has been located. The maximum grade will be 2.64 ft. per mile, and the maximum curvature 6 deg. There will be seven tunnels aggregating 9,868 ft. Six and one-half miles of the Speedwell extension have been completed during the year. The projected work includes an extension up Widemouth Creek, 5½ miles long, and a line up Big Creek, two miles long. The Guyandot & Tug River R. R. will be built from a point near the western end of the Widemouth branch, in Wyoming County, W. Va., through the valleys of Beartown Creek and Pinnacle Creek to the Guyandot River, and thence along the river to a point on the main line, a distance of 65 miles. A branch line 20 miles long will also be built through the lands of the Pocahontas Coal & Coke Company and will be known as the Barker Creek branch.

It is reported that this company will build an extension from Blair, Va., in an easterly direction to Anderson Bottoms, three miles. C. S. Churchill, Roanoke, Va., is Chief Engineer.

OREGON & EUREKA.—This company has been incorporated in California to build a railroad from Eureka to Crescent City, 90 miles. G. B. McLeod, C. A. Stewart and others of Eureka are incorporators.

PAMLICO, ORIENTAL & WESTERN.—A contract has been awarded to the W. A. Cullen Construction Company, New York, for building this railroad from Newbern, N. C., through Dayboro, Stonewall, Oriental and Vandemeer to a point in Pamlico County, 45 miles. M. De W. Stevenson, Newbern, is said to be interested. (See Construction Supplement.)

PENNSYLVANIA.—An officer writes that this company has recently bought several acres of land at Shire Oaks, Pa., with a view to laying additional tracks in its yards, but that press reports of the work contemplated have been much exaggerated.

PITTSBURG, CARNEGIE & WESTERN.—An ordinance has been introduced in the City Council of Pittsburg for permission for this company to build an elevated railroad along Duquesne Way, from Fourth street to a junction with the Pennsylvania R. R. tracks under the Fort Wayne bridge.

Press reports state that a contract has been let to Foley Bros., Pittsburg, for grading four miles of the proposed Wabash extension in Greene County, Pa. The proposed route is from Patterson's Mills south via Washington to Waynesburg. Other reports say that the contracts for the entire line have been let.

PITTSBURG, CINCINNATI, CHICAGO & ST. LOUIS.—It is stated that this company will build a coal road four miles in length from Burgettstown, Pa., on the main line, to the mines of the Pittsburg & Buffalo and the Pittsburg & Eastern coal companies near Bulger. The new line will enter a territory heretofore without means of transportation.

RICE BELT.—A contract is reported let to Johnson Bros., St. Elmo, Ill., for building this line from Galveston, Texas, southwest along the Gulf to Brownsville. It is stated that bonds for $4,000,000 will be sold through the Missouri Trust Company, St. Louis, Mo., to pay for the cost of construction. R. L. Clark, Port Lavaca, Texas, is President. (April 10, p. 274.)

ST. JOSEPH, SAVANNAH & NORTHWESTERN STREET R. R.—Articles of incorporation have been filed by this company in Missouri. It is proposed to build an electric railroad from St. Joseph, Mo., north to Savannah, 15 miles, with a probable extension through Fillmore and other towns in Andrew County. Rights of way have been secured between St. Joseph and Savannah. J. A. McLeod, J. R. Williams, C. F. Newton and W. G. Heine, all of Savannah, are incorporators.

ST. LOUIS, EL RENO & WESTERN (MISSOURI, KANSAS & TEXAS).—Press reports state that grading is practically completed on this line from Guthrie to El Reno, 42 miles, and that track laying will shortly be begun. Surveys are now being made for the remainder of the line southwest of El Reno, but the contracts for grading this part of the line will probably not be let until the early spring. (July 17, p. 534.)

SAN ANTONIO & ARANSAS PASS.—Grading is reported begun on the extension of this road from Alice, Texas, to Brownsville, 150 miles. J. P. Nelson, San Antonio, Texas, has the contract for the work. (Aug. 28, p. 624.)

SOUTHERN.—A contract has been awarded to Condon & Oliver, Knoxville, Tenn., for building a six-mile extension from a point on the Marysville branch, near Knoxville, in an easterly direction to several large manufacturing plants.

Surveys are reported in progress on an extension from Gainesville, Ga., to the Pratt, Baldwin & Scott pyrites mines near Dahlonega, 20 miles.

TENNESSEE CENTRAL.—An officer writes that this company is not building an extension from Crawford into Fentress County. (Sept. 11, p. 660.)

TUXPAN VALLEY.—An officer is reported as saying that the surveys for this line from Tuxpan, Mexico, to Jabonera, 70 miles, are practically completed, and that grading will probably be begun within the next 90 days. Geo. W. Deits, Mexico City, is Vice-President and General Manager. (See Construction Supplement.)

VARNER, CUMMINGS & EASTERN.—Work was reported begun on this road on Sept. 7. The proposed route is from Linwood, Ark., east through Douglas, Pendleton and Medford to Watson, 50 miles, with a branch to Varner. The Varner Construction Co. of Little Rock has been organized to build the line. J. A. Franklin, Little Rock, is President. (Aug. 14, p. 594.)

VINITA-ALVA.—Press reports say that a railroad will shortly be built from Vinita, Ind. T., west to Alva, Okla. T., 185 miles. It is stated that the Grigsby-Kinzer Construction Company will build the line. Surveys are now in progress.

WRIGHTSVILLE & TENNILLE.—See Railroad News.

GENERAL RAILROAD NEWS.

CANADIAN PACIFIC.—See Lindsay, Bobcaygeon & Pontypool below.

CHESAPEAKE & OHIO.—It is reported that the Quinnimont Coal Company, which operates the Laurel Creek R. R., extending from Quinnimont, Vt., to Hemlock, six miles, has been taken over by the Chesapeake & Ohio, and that the railroad line will in future be operated by the C. & O.

CHICAGO GREAT WESTERN.—This company has purchased land in Omaha, between Sixteenth and Nineteenth streets, for freight yards and a terminal station.

CINCINNATI, HAMILTON & DAYTON.—The stockholders of this company will vote on Oct. 13 on the terms of the proposed lease of the property and franchises of the Cincinnati, Findlay & Fort Wayne. This latter company was recently incorporated as the successor of the Findlay, Fort Wayne & Western, which runs from Findlay, Ohio, to Fort Wayne, Ind., 80 miles. Under the title of the Delphos & Northern, the company is about to build from Delphos, Ohio, to Cloverdale, 15 miles, for the purpose of connecting a branch of the C., H. & D. with the C., F. & F. W.

HOCKING VALLEY.—Gross earnings of this company for the fiscal year ending June 30 were $6,049,698, an increase of $733,175. Operating expenses were $3,838,526, an increase of $609,195, leaving an increase in net earnings of $123,987. After payment of fixed charges and dividend, a surplus of $922,774 remains, an increase of $193,049 over the surplus of the previous year.

LINDSAY, BOBCAYGEON & PONTYPOOL.—At a recent meeting of the stockholders of this company, it was voted to lease the road to the Canadian Pacific as soon as the entire line has been completed. The road is now building from Pontypool, Ont., on the Canadian Pacific, north to Lindsay, and thence northeast to Bobcaygeon, 40 miles. Work is proceeding rapidly and it is stated that the line will be in operation by Jan. 1, 1904. H. W. Armstrong, Lindsay, Ont., is the engineer in charge.

MINNEAPOLIS, ST. PAUL & SAULT STE. MARIE.—The report of this company for the fiscal year ending June 30 shows gross earnings of $7,293,743, an increase of $1,036,152. Operating expenses were $3,719,922, an increase of $778,295, leaving an increase in net earnings of $257,857.

NEW YORK, NEW HAVEN & HARTFORD.—The gross earnings of this company for the fiscal year ending June 30 were $47,296,077. Operating expenses were $34,955,023, leaving net earnings of $12,841,053. The report states that the large increase in operating expenses is due to the fact that the coal strikes prevented contractors from making deliveries, so that the company was compelled to purchase its fuel on such terms as could best be obtained. The cost of coal alone for the year was $1,600,000 in excess of the price paid in 1902. The gross earnings for 1903 are the largest in the history of the company.

NORTHERN PACIFIC.—The annual report of this company for the fiscal year ending June 30 shows gross earnings of $46,142,105, an increase of $4,754,725. Operating expenses were $24,032,093, an increase of $2,743,679, leaving an increase in net earnings of $2,011,046. The company appropriated $3,000,000 out of income for future improvements.

SEABOARD AIR LINE.—In the recent annual report of this company, the following statement is made with regard to the Atlanta & Birmingham Air Line now building: The East & West R. R. extends from Cartersville, Ga., on the east, to Pell City, Ala., on the west, 123 miles. The Birmingham & Atlanta Air Line was organized to build a railroad from Birmingham, Ala., to a connection with the East & West at or near Coal City, Ala., and valuable terminals were acquired at Birmingham. A separate charter was secured in Georgia in the name of the Chattahoochee Terminal, for a railroad from a point on the main line of the Seaboard Air Line near Atlanta, to a junction with the extension of the East & West at a point about 14 miles to the northwest of Atlanta. These three railroads were then consolidated into one under the name of the Atlanta & Birmingham Air Line. This company, therefore, owns all the property formerly owned by the East & West, the Birmingham & Atlanta Air Line and the Chattahoochee Terminal, and is rapidly building the necessary links to complete the line from Atlanta to Birmingham. The new portion from Coal City to Birmingham, and from Howells to Rockmart is being laid with 75-lb. rails. The new bonds of the S. A. L. secured by the property of the Atlanta & Birmingham Air Line, are not to exceed $10,000,000, and must not be issued to exceed $30,000 per mile. Six millions of these bonds have been sold to a syndicate and will be issued as the work progresses. The Seaboard Air Line owns the entire capital stock of the Atlanta & Birmingham Air Line, and on the completion of the new road will, no doubt, absorb the A. & B.

WRIGHTSVILLE & TENNILLE.—At the next meeting of the stockholders of this company, the proposition will be voted upon to increase the capital stock, with a view to extending the line from Hawkinsville, Ga., southwest to Cordelle, 30 miles. A. F. Daley, Tennille, Ga., is President.

YAZOO & MISSISSIPPI VALLEY.—The gross earnings of this company for the year ending June 30 were $7,330,085, an increase of $742,799. Operating expenses were $5,673,160, an increase of $947,532, leaving a decrease in net earnings of $225,493. In explanation of the large increase in operating expenses, President Fish says that it was due to damage and delay by floods and the increased cost of material and fuel; and also to the enforced payment of back taxes aggregating $282,895. This latter sum was deducted from earnings.